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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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Volume 11 Number 9 / May 8, 1973

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page

01 Aerodynamics 979
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 982
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 990
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 992
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 997
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 998
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 1001
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

page

08 Computers 1005
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 1007
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 1009
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 1010
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 1012
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 1020
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 1034
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 1038
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 1042
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 1045
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

page

18 Materials, Nonmetallic 1050
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 1056
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 1058
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1062
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 1063
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 1064
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 1068
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

25 Physics, Plasma 1069
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 1073
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 1077
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

page

28 Propulsion Systems 1078
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 1080
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 1082
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1086
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1092
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 1098
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 1100
Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

page

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-51
CORPORATE SOURCE INDEX I-57
CONTRACT NUMBER INDEX I-71
REPORT/ACCESSION NUMBER INDEX I-75

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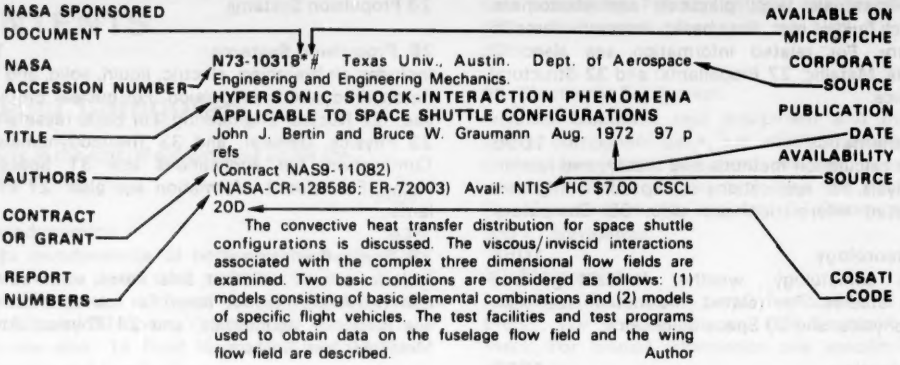
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The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

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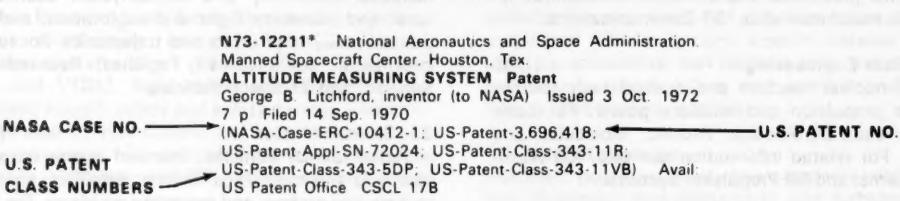
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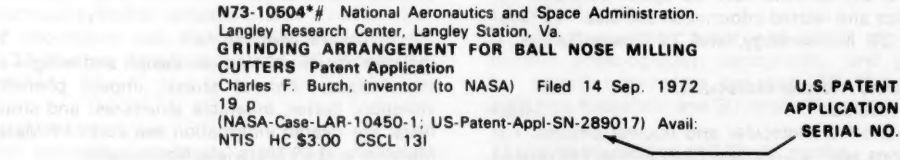
U.S. PATENT CLASS NUMBERS
U.S. PATENT NO.
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION


U.S. PATENT APPLICATION SERIAL NO.
N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT

PLACE OF MEETING
EXCEPTION PRICING
SUBSIDIARY ANALYTIC ACCESSIONS
N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A
The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

PRIMARY ANALYTIC ACCESSION AND LOCATION OF FULL CITATION AND ABSTRACT
PAGES IN PRIMARY REPORT
N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume In NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02) CSCL 01A

VOLUME 11 NUMBER 9 / MAY 8, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-17999*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 24, NOVEMBER 1972
Nov. 1972 118 p refs
(NASA-SP-7037(24)) Avail: NTIS HC $3.00 CSCL 01A

This special bibliography lists 399 reports, articles, and other documents introduced into the NASA scientific and technical information system in October 1972. Author

N73-18000*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HEATING AND FLOW-FIELD STUDIES ON A STRAIGHT-WING HYPERSONIC REENTRY VEHICLE AT ANGLES OF ATTACK FROM 20 TO 80 DEG WITH SIMULATION OF REAL-GAS TRENDS
James L. Hunt Washington Mar. 1973 96 p refs
(NASA-TN-D-7108; L-7946) Avail: NTIS HC $3.00 CSCL 22C

Data are presented from a series of phase-change heat transfer and flow visualization tests at Mach 7.4, 8, and 10.3 in air, Mach 19.5 in nitrogen, Mach 20.3 in helium, and Mach 6 in tetrafluoromethane (CF4) on the windward surface of a straight wing hypersonic reentry configuration for angles of attack from 20 deg to 80 deg. The results indicate that: (1) for hypersonic stream Mach numbers, the flow field over the straight-wing configuration is essentially independent of Mach number, (2) transition Reynolds number decreases with increasing angle of attack, (3) at some critical angle of attack, the wing-shock standoff distance is greatly increased and the stagnation line moves downstream from the wing leading edge, (4) value of the critical angle of attack is very sensitive to the flow shock density ratio or effective gamma, and (5) at angles of attack above the critical value for all gases, the nondimensional level of heat transfer to the wing is higher for the higher shock density ratio flows. Author

N73-18001*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A METHOD FOR PREDICTING SHOCK SHAPES AND PRESSURE DISTRIBUTIONS ON TWO DIMENSIONAL AIRFOILS AT LARGE ANGLES OF ATTACK
George E. Kaattari Washington Mar. 1973 49 p refs
(NASA-TN-D-7197; A-4564) Avail: NTIS HC $3.00 CSCL 01A

A method is presented for determining shock envelopes and pressure distributions for two-dimensional airfoils at angles of attack sufficiently large to cause shock detachment and subsonic flow over the windward surface of the airfoil. Correlation functions obtained from exact solutions are used to relate the shock standoff distance at the stagnation and sonic points of the body through a suitable choice for the shock shape. The necessary correlation functions were obtained from perfect gas solutions but may be extended to any gas flow for which the normal shock-density ratio can be specified. Author

N73-18002*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPARISON OF THE AERODYNAMIC CHARACTERISTICS OF AN ABLATING AND NONABLATING BLUNTED CONICAL BODY
Robert L. Kruse Washington Mar. 1973 25 p refs
(NASA-TN-D-7196; A-4558) Avail: NTIS HC $3.00 CSCL 01A

The influence of ablation on the aerodynamic characteristics of a blunted slender cone was investigated. Plastic models were launched in free flight at ablating conditions. The results were compared with results of similar tests using metal nonablating models. Ablation was found to decrease the dynamic stability and the drag, but had little effect on static stability and lift. The plastic models appeared to experience ablation-induced roll. Author

N73-18003*# Bell Aerospace Co., Buffalo, N.Y.
DEVELOPMENT AND APPLICATIONS OF SUPERSONIC UNSTEADY CONSISTENT AERODYNAMICS FOR INTERFERING PARALLEL WINGS
Kari Appa and G. C. C. Smith Washington NASA Mar. 1973 57 p refs
(Contract NAS1-10880)
(NASA-CR-2168) Avail: NTIS HC $3.00 CSCL 01A

The analytical development of unsteady supersonic aerodynamic influence coefficients for isolated and nearly parallel interfering coplanar and noncoplanar wings is described. Numerical formulations based on triangular discretizations of wings and diaphragms are handled in a kinematically consistent manner. Examples of isolated wing cases are compared with respect to aerodynamic influence coefficients and flutter boundaries. Aerodynamic influence coefficients for interfering wings are compared where corresponding results are available. Author

N73-18004# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Aerodynamik.
INFLUENCE OF THE TRAILING EDGE SHAPE ON THE DRAG OF A RECTANGULAR WING IN THE MACH NUMBER RANGE FROM FREE STREAM MACH .5 TO 2.2
M. Tanner 1971 93 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-85) Avail: NTIS HC $6.75; DFVLR Porz-Wahn: 28,80 DM

Drag and lift measurements were performed on two rectangular wings with an aspect ratio of 2 in the Mach number range from free stream Mach 0.5 to 2.2. The one wing had a sharp trailing edge and the other a blunt trailing edge. The shape of the blunt trailing edge and its thickness was varied. By using a broken trailing edge shape the drag of the wing

with a blunt trailing edge was remarkably reduced. The total drag was split up in its components in order to show the magnitude of the various drag components. Author

N73-18005# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.

THEORETICAL PARAMETER STUDIES OF WING-FUSELAGE-COMBINATIONS

Horst Koerner 1972 40 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-63) Avail: NTIS HC $4.00; DFVLR Porz: 11 DM

A parameter study is presented concerning the influence of the main geometry parameters on the aerodynamic characteristics of a wing-fuselage-combination in incompressible flow. For this study a prediction-method for wing-fuselage-combinations with cylindrical fuselages developed by H. Korner is used. The parameters investigated within this study are body-diameter, wing-position, sweep, planform-taper, and aspect ratio. Results are given for the lift slope and the aerodynamic centre of the total arrangement, in some cases also the local values along the span. Author

N73-18006# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). (AVA)-Abteilung Aeroelastik.

CALCULATION OF THE UNSTEADY PRESSURE DISTRIBUTIONS ON HARMONICALLY OSCILLATING SLENDER CRUCIFORM WING AND CYLINDRICAL BODY COMBINATIONS

K. L. Chao 1971 96 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-87) Avail: NTIS HC $7.00; DFVLR Porz-Wahn: 28,80 DM

Based upon the Slender-Body-Theory the theoretical relations for an analytical determination of the pressure distributions on harmonically oscillating slender cruciform wing and cylindrical body combinations in compressible flow are presented. For the analytical solution of the Laplace equation the method of conformal mapping has been applied, where the cross-section geometry is transformed into a straight line. The mutual interference effects of the cruciform wings and the influences of the fuselage body are investigated in detail for heaving, pitching and rolling oscillations. Author

N73-18007# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

UNSTEADY PRESSURE MEASUREMENTS ON A HARMONICALLY OSCILLATING WING MODEL IN THREE DIMENSIONAL COMPRESSIBLE FLOW

H. Triebstein 1972 135 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-55) Avail: NTIS HC $8.75; DFVLR Porz-Wahn: 43,20 DM

Measurements of the unsteady pressure on a harmonically oscillating rectangular half wing model with control surface in three-dimensional compressible flow have been carried out at numerous parameter variations. For these measurements, which took place in the Transonic Wind Tunnel of DFVLR-AVA in Goettingen, a new test set-up has been developed. The model was performing pitching oscillations about the 1/4- and the half chord axis in the Mach regime Ma = 0.5 until 1.2; the Reynolds number regime was Re = 1.3 x 10 to the 6th power until 4.8 x 10 to the 6th power. The investigations have been carried out with reduced frequencies omega * = omega 1/2V = 0.051 up to 0.218. The experimental results are compared with corresponding theoretical results stemming from three-dimensional lifting surface theory and with relating experimental results from Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam. In particular, the effects of the vibration amplitude, the angle of attack and the Reynolds number upon the unsteady pressure distributions were investigated in detail. Author

N73-18008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). (AVA)-Abteilung.

FORCE AND PRESSURE DISTRIBUTION MEASUREMENTS ON A WING-BODY COMBINATION WITH WING OF LOW ASPECT RATIO IN COMPRESSIBLE FLOW

W. Stahl, K. Hartmann, and W. Schneider 1972 39 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-08) Avail: NTIS HC $4.00; DFVLR Porz-Wahn: 12, DM

In the transonic wind tunnel of the Aerodynamische Versuchsanstalt Goettingen experimental investigations were carried out on a wing-body combination with a delta wing of low aspect ration (Lambda = 0.52). The wing extended along most of the body, which was a circular cylinder with an ogival nose. Mach numbers ranged from Ma = 0.5 to 2.2, covering the transonic regime. Normal forces and pitching moments were measured as well as spanwise pressure distributions in several sections on the pressure and suction sides. Oil-flow and smoke pictures gave some insight into the flow field. The Reynolds number, formed with 2/3 of the length of the wing was held constant at Re = 2,700,000 for all Mach numbers. The influence of the Reynolds number was investigated at Mach numbers Ma = 0.5, 1.0 and 1.8. Angles of incidence varied from alpha approximates 0 deg to alpha approximates 30 deg. For comparison purposes the results of the wing alone were available; they had been obtained at AVA in earlier investigations. Author

N73-18009*# Scripta Technica, Inc., Washington, D.C.

GAS FLOWS PAST BLUNT BODIES. PART 1: CALCULATION METHOD

A. N. Lyubimov and V. V. Rusanov NASA Feb. 1973 383 p refs Transl. into ENGLISH of the publ. "Techeniya Gaza Okolo Tupykh Tel. Chast 1: Metod Rascheta i Analiz Techeniy" Moscow, Nauka, 1970 280 p

(Contract NASw-2036)

(NASA-TT-F-714) Avail: NTIS HC $6.00 CSCL 20D

A method of finite differences for calculation of three-dimensional nonsteady flows of a gas past blunt bodies is presented. Plane, axisymmetric, and three-dimensional steady flows of a perfect gas and an ideal gas are analyzed with consideration of physicochemical transformations. The flow analyses are made with special processing algorithms on the basis of systematically calculated data for various cases of flow past a sphere, paraboloids, ellipsoids, hyperboloids, blunt cones, and other bodies. Author

N73-18010*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THEORETICAL AND EXPERIMENTAL INTERNAL FLOW CHARACTERISTICS OF A 13.97-CENTIMETER-DIAMETER INLET AT STOL TAKEOFF AND APPROACH CONDITIONS

James A. Albers Washington Mar. 1973 23 p refs

(NASA-TN-D-7185; E-7237) Avail: NTIS HC $3.00 CSCL 01A

The theoretical and experimental internal flow characteristics of a 13.97-cm-diam inlet with centerbody retracted and extended are presented at STOL takeoff and approach operating conditions. The theoretical results were obtained from incompressible potential flow corrected for compressibility and boundary layer. Comparisons between theoretical internal surface static-pressure distributions and experimental data are presented for free-stream velocities of 0, 24, 32, and 45 m/sec for a range of inlet incidence angles from 0 to 50 deg. Surface static-pressure distributions are illustrated at circumferential locations of 0, 60, 120, and 180 deg. Surface Mach number distributions from the stagnation point to the diffuser exit are presented along with turbulent boundary-layer shape factors. In general, good agreement was found between the theoretical and experimental surface static pressure distributions. Author

N73-18011*# Hamilton Standard, Windsor Locks, Conn.

ANALYTICAL PARAMETRIC INVESTIGATION OF LOW PRESSURE RATIO FAN NOISE

F. B. Metzger, D. B. Hanson, R. W. Menthe, and G. B. Towle Washington NASA Mar. 1973 118 p refs

(Contract NAS1-10896)

(NASA-CR-2188; HSER-5990) Avail: NTIS HC $3.00 CSCL 01B

The results of an analytical study are reported which shows the effect of various physical and operating parameters on noise

produced by low pressure ratio propulsive fans operating at subsonic top speeds. Acoustical duct lining effects are included in the study. The concepts used to develop the noise theory used in the study, as well as the correlation between the theory and model test results are also presented. It is shown that good correlation has been established between theory and experiment. Using the theory, it is shown that good aerodynamic design, maximum acceptable fan solidity, low tip speed operation and use of few blades and vanes leads to the lowest noise levels. Typical results of the study indicate that a fan operating at 1.2 fan pressure ratio and 700 ft/second tip speed with 12 blades and 7 vanes and including modest acoustic treatment on the duct wall would produce levels allowing a 100,000 lb. STOL aircraft to meet a noise level objective of 95 Pndb at 500 ft at takeoff. Author

N73-18012*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF VANE-INDUCED ROTATION ON DIFFUSER FLOW DISTORTION IN AN AXISYMMETRIC MIXED-COMPRESSION INLET

Edward T. Meleason Washington Feb. 1972 36 p refs

(NASA-TM-X-2752; E-7245) Avail: NTIS HC $3.00 CSCL 20D

An investigation of vane-induced flow rotation to modify distorted steady-state total-pressure patterns in the subsonic diffuser of a supersonic mixed-compression inlet was conducted. Radial static-pressure gradients generated by the rotation were the mechanism used to modify the total-pressure distributions. Significant redistribution of circumferential distortion patterns into more compatible radial patterns was realized, but flow problems near the duct walls reduced the general effectiveness of the technique. Total-pressure losses associated with the swirl vanes were slight. Limited turbulence data indicated that vane installation resulted in reduced turbulence levels. Author

N73-18013*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

MEASUREMENTS OF SURFACE-PRESSURE FLUCTUATIONS ON THE XB-70 AIRPLANE AT LOCAL MACH NUMBERS UP TO 2.45

Thomas L. Lewis, Jules B. Dods, Jr., and Richard D. Hanly Washington Mar. 1973 35 p refs

(NASA-TN-D-7226; H-714) Avail: NTIS HC $3.00 CSCL 01C

Measurements of surface-pressure fluctuations were made at two locations on the XB-70 airplane for nine flight-test conditions encompassing a local Mach number range from 0.35 to 2.45. These measurements are presented in the form of estimated power spectral densities, coherence functions, and narrow-band-convection velocities. The estimated power spectral densities compared favorably with wind-tunnel data obtained by other experimenters. The coherence function and convection velocity data supported conclusions by other experimenters that low-frequency surface-pressure fluctuations consist of small-scale turbulence components with low convection velocity. Author

N73-18014*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

WIND-TUNNEL CALIBRATION AND REQUIREMENTS FOR IN-FLIGHT USE OF FIXED HEMISPHERICAL HEAD ANGLE-OF-ATTACK AND ANGLE-OF-SIDESLIP SENSORS

Earl J. Montoya Washington Mar. 1973 47 p refs

(NASA-TN-D-6986; H-702) Avail: NTIS HC $3.00 CSCL 14B

Wind-tunnel tests were conducted with three different fixed pressure-measuring hemispherical head sensor configurations which were strut-mounted on a nose boom. The tests were performed at free-stream Mach numbers from 0.2 to 3.6. The boom-angle-of-attack range was -6 to 15 deg, and the angle-of-sideslip range was -6 to 6 deg. The test Reynolds numbers were from 3.28 million to 65.6 million per meter. The results were used to obtain angle-of-attack and angle-of-sideslip calibration curves for the configurations. Signal outputs from the hemispherical head sensor had to be specially processed to obtain accurate real-time angle-of-attack and angle-of-sideslip measurements for pilot displays or aircraft systems. Use of the fixed sensors in flight showed them to be rugged and reliable and suitable for use in a high temperature environment. Author

N73-18015# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.

DRAG MEASUREMENTS OF OSCILLATING CYLINDER AT LOW REYNOLDS NUMBERS Ph.D. Thesis - Tech. Univ. Berlin [WIDERSTAHPSMESSUNGEN AM SCHWINGENDEN ZYLINDER BEI KLEINEN REYNOLDS-ZAHLEN]

Momtaz Sedrak 1 Jul. 1971 83 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-42) Avail: NTIS HC $6.25; DFVLR, Porz, West Ger. 22,60 DM

Measurements of the drag and the velocity distribution in the wake of a cylinder were made for the Reynolds number range between 34 and 215. For the case of the oscillating cylinder and the cylinder at rest, the experiments were carried out using the hot-wire and self balancing microtorsion balance technique. The mechanism of eddy shedding causes the system to act as a self-excited oscillator. The parameters of the system were evaluated by means of a dimensional analysis. They show a similarity to the van der Pol equation for a self-excited oscillator. Author (ESRO)

N73-18016# East Anglia Univ., Norwich (England). School of Mathematics and Physics.

CALCULATION OF THE EFFECT OF BLOWING FROM THE LEADING EDGES OF A SLENDER DELTA WING

J. E. Barsby London Aeron. Res. Council. 1972 79 p refs Supersedes RAE-TR-71077; ARC-33029 Sponsored by Min. of Defence

(ARC-R/M-3692; RAE-TR-71077; ARC-33029) Avail: NTIS HC $6.00; HMSO £ 2.75; PHI $10.80

The thin-jet model, applied to the study of the jet flap, is combined with the vortex-sheet model, applied to the study of leading-edge separation, to study the effect of blowing from the leading edges of a delta wing at incidence. A jet-vortex supporting a pressure difference related to the curvature of the streamlines in it, leaves the leading edge in a direction tangential to the wing plane and rolls up into a spiral above the wing. The inner part of the spiral is replaced by an asymptotic representation and the properties of this configuration are calculated by slender-body theory for the case of conical flow. The effect of the three basic parameters; the coefficient of blowing momentum, the initial angle between the jet streamlines and the leading edge, and the ratio of the angle of incidence to the apex angle of the wing, are covered in the calculations. Blowing is shown to increase the lift on the wing and to increase the circulation about the vortex, while displacing it upwards and outboard. Comparisons with experimental results are encouraging. Author (ESRO)

N73-18017# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany): Inst. fuer Angewandte Gasdynamik.

INFLUENCE OF ELECTRON BEAM BLUNT BODY INTERACTIONS ON DENSITY MEASUREMENTS IN TRANSITION FLOW

Gustav Schweiger, Kurt Wanders, and Manfred Becker 1973 18 p refs Presented at the 8th Intern. Rarefied Gas Dyn. Symp., Stanford, Calif., 1972

(DLR-FB-73-08) Avail: NTIS HC $3.00; DFVLR Porz-Wahn: 7,20 DM

An electron beam was scanned over the flow field of a blunt body for the purpose of density measurement. It was found that when the electron beam hits the surface, secondary electrons are produced which cause additional fluorescence near the wall. This effect was investigated more in detail. The density was determined by a photographic method which gives an equal density representation; however, the influence of the secondary electrons must be taken into account. The density measurements near the wall were corrected and verified by pressure and heat transfer measurements. Author (ESRO)

N73-18018# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

THE MEASUREMENT AND ANALYSIS OF THE PROFILE

DRAG OF A WING WITH A SLOTTED FLAP
I. R. M. Moir, D. N. Foster, and D. R. Holt (Hawker Siddeley Aviation, Brough, Engl.) London Aeron. Res. Council 1972 37 p refs Supersedes RAE-TR-71158; ARC-33663
(ARC-CP-1233; RAE-TR-71158; ARC-33663) Avail: NTIS HC $4.00; HMSO 60 p; PHI $2.65

Measurements of lift, drag, and pitching moments were made on a wing section for a range of flap deflections under conditions which were as close as possible to two-dimensional flow. The corrected data are presented together with the results of a semi-empirical analysis of sectional profile drag. It is shown that a consistent analysis can be made of the results over a range of flap angles and incidence, limited by a requirement for acceptable wing and flap boundary layer conditions, precluding significant flow separations. Under these conditions it appears that such an approach could serve as a general basis for correlating and interpreting experimental data on high-lift mechanical flap arrangements. Author (ESRO)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-18019*# Youngstown State Univ., Ohio. William Rayen School of Engineering.
A SOLID STATE CONVERTER FOR MEASUREMENT OF AIRCRAFT NOISE AND SONIC BOOM Final Report, 1 Sep. 1971 - 31 Aug. 1972
Allan J. Zuckerwar 30 Nov. 1972 61 p refs
(Grant NGR-36-028-004)
(NASA-CR-112260) Avail: NTIS HC $5.25 CSCL 20A

The problems inherent in present systems of instrumentation for measuring aircraft noise and sonic boom include limited frequency response, expensive connecting cables, sensitivity to cable length and type, high sensitivity to environmental conditions, and additional limitations of individual system components. Furthermore, differing requirements have resulted in the use of two different systems for aircraft noise and sonic boom measurements respectively. To alleviate these difficulties a unified system of instrumentation suitable for both types of measurements was developed. The system features a new solid state converter connected to a zero drive amplifier. The system was found insensitive to cable length and type up to at least 1000 ft and requires no impedance matching networks. The converter itself has flat frequency response from dc to 28 kHz (- 3 db), dynamic range of 72 db, and noise floor of 50 db in the band 22.4 Hz to 22.4 kHz. Author

N73-18020*# California Inst. of Tech., Pasadena.
EXPERIMENTAL STUDY OF FLOW ABOUT A STALLED TWO-DIMENSIONAL AIRFOIL Semiannual Status Report, Jun. - Dec. 1972
D. Coles, A. Wadcock, and B. Cantwell Jan. 1973 25 p
(Grant NGL-05-002-229)
(NASA-CR-130919; SASR-2; SASR-3) Avail: NTIS HC $3.25 CSCL 01C

Wind tunnel tests to determine the flow characteristics of a stalled wing are described. The advantages of the plane wing over the ring wing for wind tunnel investigations are presented. The general flow pattern for stalled ring airfoils is developed. Photographs of the test equipment and installation are provided. Author

N73-18021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INITIAL FLIGHT AND SIMULATOR EVALUATION OF A HEAD UP DISPLAY FOR STANDARD AND NOISE ABATEMENT VISUAL APPROACHES
Kent Bourquin, Everett Palmer, George Cooper, and Ronald Gerdes Feb. 1973 39 p refs
(NASA-TM-X-62187) Avail: NTIS HC $4.00 CSCL 01B

A preliminary assessment was made of the adequacy of a simple head up display (HUD) for providing vertical guidance for flying noise abatement and standard visual approaches in a jet transport. The HUD featured gyro-stabilized approach angle scales which display the angle of declination to any point on the ground and a horizontal flight path bar which aids the pilot in his control of the aircraft flight path angle. Thirty-three standard and noise abatement approaches were flown in a Boeing 747 aircraft equipped with a head up display. The HUD was also simulated in a research simulator. The simulator was used to familiarize the pilots with the display and to determine the most suitable way to use the HUD for making high capture noise abatement approaches. Preliminary flight and simulator data are presented and problem areas that require further investigation are identified. Author

N73-18022*# Boeing Co., Seattle, Wash.
FLIGHT TEST MEASUREMENTS AND ANALYSIS OF SONIC BOOM PHENOMENA NEAR THE SHOCK WAVE EXTREMITY
George T. Haglund and Edward J. Kane Washington NASA Feb. 1973 178 p refs
(Contract NAS1-10992)
(NASA-CR-2167; D6-40758) Avail: NTIS HC $3.00 CSCL 20A

The sonic boom flight test program conducted at Jackass Flats, Nevada, during the summer and fall of 1970 consisted of 121 sonic-boom-generating flights over the 1500 ft instrumented BREN tower. This test program was designed to provide information on several aspects of sonic boom, including caustics produced by longitudinal accelerations, caustics produced by steady flight near the threshold Mach number, sonic boom characteristics near lateral cutoff, and the vertical extent of shock waves attached to near-sonic airplanes. The measured test data, except for the near-sonic flight data, were analyzed in detail to determine sonic boom characteristics for these flight conditions and to determine the accuracy and the range of validity of linear sonic boom theory. The caustic phenomena observed during the threshold Mach number flights and during the transonic acceleration flights are documented and analyzed in detail. The theory of geometric acoustics is shown to be capable of predicting shock wave - ground intersections, and current methods for calculating sonic boom pressure signature away from caustics are shown to be reasonably accurate. Author

N73-18023# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON FLUID DYNAMICS PANEL SPECIALISTS MEETING ON FLUID DYNAMICS OF AIRCRAFT STALLING
R. C. Pankhurst (Royal Aircraft Estab., Teddington, UK) Nov. 1972 11 p refs Conf. held at Lisbon, 26-28 Apr. 1972
(AGARD-AR-49) Avail: NTIS HC $3.00

An evaluation of the fluid dynamics of aircraft stalling is presented. The aerodynamic characteristics of the aircraft stall at both low and high speeds are discussed. Particular reference is made to the design and operation of combat and transport aircraft, including buffet penetration and post-stall behavior. Major subject areas concern flight experience, flight testing, wind tunnel measurements, and theoretical prediction methods. The effects of three dimensional flow, the influence of sweep back, and the design and performance of light lift devices are analyzed. Author

N73-18024*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
ACTIVE TRANSMISSION ISOLATION/ROTOR LOADS MEASUREMENT SYSTEM Final Report
Irwin J. Kenigsberg and John J. DeFelice 1 Mar. 1973 139 p refs Sponsored in part by Army Air Mobility Res. and Devel. Lab.
(Contract NAS1-11549)
(NASA-CR-112245; SER-50821) Avail: NTIS HC $9.00 CSCL 01B

Modifications were incorporated into a helicopter active transmission isolation system to provide the capability of utilizing the system as a rotor force measuring device. These included:

(1) isolator redesign to improve operation and minimize friction, (2) installation of pressure transducers in each isolator, and (3) load cells in series with each torque restraint link. Full scale vibration tests performed during this study on a CH-53A helicopter airframe verified that these modifications do not degrade the systems wide band isolation characteristics. Bench tests performed on each isolator unit indicated that steady and transient loads can be measured to within 1 percent of applied load. Individual isolator vibratory load measurement accuracy was determined to be 4 percent. Load measurement accuracy was found to be independent of variations in all basic isolator operating characteristics. Full scale system load calibration tests on the CH-53A airframe established the feasibility of simultaneously providing wide band vibration isolation and accurate measurement of rotor loads. Principal rotor loads (lift, propulsive force, and torque) were measured to within 2 percent of applied load. Author

N73-18025*# North Carolina State Univ., Raleigh.
AN ANALYTICAL STUDY OF THE RESPONSE OF A CONSTANT-ATTITUDE AIRCRAFT TO ATMOSPHERIC TURBULENCE
Frederick O. Smetana and Ronald K. Carden Washington NASA Mar. 1973 51 p refs
(Contract NAS1-9603)
(NASA-CR-2204) Avail: NTIS HC $3.00 CSCL 01B

A light airplane equipped with an automatic control system which drives large wing flaps and the stabilator so as to produce a constant pitch attitude in all flight modes was analyzed for its response to a specific gust. The aircraft was also equipped with a bank-angle steering, zero sideslip automatic control system which was studied for its effectiveness in suppressing a specific lateral gust. The gusts were assumed to be comprised of 200 lateral and 400 vertical sinusoids. Each was used to excite the controlled aircraft, and the time response to the sum of all sinusoids was plotted. The assumption was that the gust may be treated as stationary in space but variable in time rather than the reverse. Results indicate that such a control system can suppress vertical gusts up to the limit of control authority. Either the lateral accelerations or the yawing velocity response to lateral gusts can be suppressed with this system but not both simultaneously. Author

N73-18026# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Drehfluegelflugzeuge.
CALCULATION OF THE FLAPWISE BENDING, EDGEWISE BENDING AND TORSIONAL VIBRATIONS OF ROTOR BLADES WITH COUPLED NATURAL MODES AND FREQUENCIES
Hans Oette 1971 82 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-108) Avail: NTIS HC $6.25; DFVLR Porz: 18,50 DM

The natural mode method is expanded from one to two degrees of freedom for three coupled degrees of flapwise bending, edgewise bending and torsion. For the coupled natural modes known, the orthogonal relations are arranged and the differential equations for the generalized degrees of freedom are derived. The theory is still extended by adding the moment of inertia due to the extension of the blade across to its axis and applying a flapping coordinate system. For the numerical examples the following items are taken into account: The forward flight data of the S-61 -helicopter, coupled natural modes computed by the multihinge articulated blade method, and schematized nonstationary aerodynamic coefficient curves. Author

N73-18027# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
DYNAMIC AND AEROELASTIC PROBLEMS OF STOP-ROTORS AND THEIR ANALYTICAL TREATMENT. PART 1: ANALYTICAL DETERMINATION OF THE NATURAL VIBRATIONS OF ROTOR BLADES AND THE STEADY AND UNSTEADY AIRLOADS ON THE BLADE DURING STOPPING AND RETRACTING
H. Foersching and G. Kotowski 1972 133 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-65-Pt-1) Avail: NTIS HC $8.75; DFVLR Porz-Wahn: 42 DM

Some dynamic and aeroelastic problems of stop-rotors of V/STOL-aircraft, occurring during retracting and stowing the blades, are treated in detail. In the first part of the investigations presented in this report first the physical background of rotor dynamic phenomena is discussed by means of some typical experimental results. Then, for an analytical treatment of these problems, the basic elastomechanical and aerodynamic relations are elaborated, in particular, methods for calculating the characteristic vibration behavior of rotor blades with initial twist, the generalized dynamic equations, and the aerodynamic loads on the blade during stopping and retracting. As a typical example the calculation of the natural vibrations of a rotor blade is presented in an appendix. Author

N73-18028# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A DETERMINISTIC MODEL OF SONIC BOOM PROPAGATION THROUGH A TURBULENT ATMOSPHERE
B. H. K. Lee and H. S. Ribner Ottawa Natl. Res. Council of Can. Nov. 1972 24 p refs Sponsored by Natl. Res. Council of Can.
(NRC-12981; LR-566) Avail: NTIS HC $3.25

The propagation of a weak normal shock wave through a turbulent atmosphere is studied in terms of an idealized model. The turbulent field is assumed to be weak and represented by the superposition of two inclined shear waves of opposite inclination to the mean flow. The resulting flow is of a cellular nature. The cells are rectangular in shape and the sense of rotation of the flow alternates from cell to cell. If the angles made by the normal of the incident shear waves with the direction of the mean flow are greater than some critical value, an exponentially decaying pressure wave is generated behind the shock. Spiked or rounded waveforms are obtained by adding or subtracting this pressure wave from the steady state pressure field. An illustrative example for a mean flow Mach number of 1.0005 is considered. This gives a steady state overpressure of 2.45 pounds per square foot across the shock which is typical of the overpressure in a sonic boom. Author

N73-18029# Cranfield Inst. of Technology (England). Coll. of Aeronautics.
A COMPARATIVE ASSESSMENT OF THREE METHODS OF MEASUREMENT OF PRESSURE ERROR CORRECTIONS
M. E. Eshelby Jun. 1972 25 p refs
(CRANFIELD-AERO-11) Avail: NTIS HC $3.25

Three methods of evaluating the pressure error of an aircraft pitot-static system are presented. The relative merits of each method are compared. In particular the determination of static pressure error by a trailing cone is considered as a method suitable for use on light aircraft and comparison is made between the pressure error measured by the cone and the other methods. Author

N73-18030# Advisory Group for Aerospace Research and Development, Paris (France).
RECENT DEVELOPMENTS IN FLIGHT FLUTTER TESTING IN THE UNITED STATES. SUPPLEMENT TO THE MANUAL ON AEROELASTICITY, VOLUME 4, CHAPTER 10
E. F. Baird (Grumman Aerospace Corp.) and W. B. Clark (Grumman Aerospace Corp.) Dec. 1972 27 p refs Presented at 34th AGARD Struct. and Mater. Panel Meeting, Lyngby, Denmark, 11 Apr. 1972
(AGARD-R-596) Avail: NTIS HC $3.50

Advances in the rapid and accurate determination of flutter characteristics through the use of high speed computers are discussed. Comments are presented on some flight flutter testing procedures in use and under development. A model matching technique is described. This technique reduces data analysis time and is compatible with relatively fast data acquisition. Results of model matching when applied to theoretical response data are presented and compared with actual flight flutter testing. Author

N73-18031*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TAKEOFF CERTIFICATION CONSIDERATIONS FOR LARGE SUBSONIC AND SUPERSONIC TRANSPORT AIRPLANES USING THE AMES FLIGHT SIMULATOR FOR ADVANCED AIRCRAFT

C. Thomas Snyder, Fred J. Drinkwater, III, Emmett B. Fry, and Raymond D. Forrest (FAA, Washington, D. C.) Washington Mar. 1973 76 p refs Prepared in cooperation with FAA, Washington, D. C.
(NASA-TN-D-7106; A-3778) Avail: NTIS HC $3.00 CSCL 01B

Data for use in development of takeoff airworthiness standards for new aircraft designs such as the supersonic transport (SST) and the large wide-body subsonic jet transport are provided. An advanced motion simulator was used to compare the performance and handling characteristics of three representative large jet transports during specific flight certification tasks. Existing regulatory constraints and methods for determining rotation speed were reviewed, and the effects on takeoff performance of variations in rotation speed, pitch attitude, and pitch attitude rate during the rotation maneuver were analyzed. A limited quantity of refused takeoff information was obtained. The aerodynamics, wing loading, and thrust-to-weight ratio of the subject SST resulted in takeoff speeds limited by climb (rather than lift-off) considerations. Take-off speeds based on U.S. subsonic transport requirements were found unacceptable because of the criticality of rotation-abuse effects on one-engine-inoperative climb performance. Adequate safety margin was provided by takeoff speeds based on proposed Anglo-French supersonic transport (TSS) criteria, with the limiting criterion being that takeoff safety speed be at least 1.15 times the one-engine-inoperative zero-rate-of-climb speed. Various observations related to SST certification are presented. Author

N73-18032# Aeronautical Center, Oklahoma City, Okla. Flight Standards Technical Div.
A SUMMARY OF CRASHWORTHINESS INFORMATION FOR SMALL AIRPLANES
Feb. 1973 125 p refs
(FAA-TR-FS-70-592-120A) Avail: NTIS HC $8.25

An analysis of parameters affecting the safety of occupants of light aircraft in the event of a crash is presented. The data involves: (1) airframe design, (2) interior components, (3) restraint systems, (4) protective padding, and (5) types of hazards encountered. The test facilities and research programs for simulating aircraft accidents to determine extent of aircraft damage and nature of the forces developed are described. Human tolerance to impact deceleration forces and the extremity strike envelope for the human body under various types of restraint are analyzed. P.N.F.

N73-18033# Cranfield Inst. of Technology (England).
AEROPLANE DESIGN STUDY STOL AIRLINER (A71). PART 2: DETAIL DESIGN FEATURES
D. Howe Jul. 1972 33 p refs
(AERO-13-Pt-2) Avail: NTIS HC $3.75

Detail design features of a short takeoff and landing commercial aircraft are presented. The design of the structures and systems is conventional in most respects. The need to provide a long stroke undercarriage for STOL operations incurred a large weight penalty. The design has demonstrated an inability to cope with engine failure and gusting cross wind conditions. The effect of the STOL requirement on the overall airframe construction is analyzed. Author

N73-18034*# Lockheed-California Co., Van Nuys. Rotary Wing Div.
VIBRATION AND LOADS IN HINGELESS ROTORS. VOLUME 1: THEORETICAL ANALYSES
G. A. Watts and R. J. London Sep. 1972 278 p refs Sponsored in part by Army Air Mobility Res. and Develop. Lab. 2 Vol.
(Contract NAS2-5168)
(NASA-CR-114562) Avail: NTIS HC $16.00 CSCL 01C

Analytic methods are developed for calculating blade loads and shaft-transmitted vibratory forces in stiff bladed hingeless rotors operating at advance ratios from mu = .3 to mu = 2.0. Calculated shaft harmonic moments compared well with experimental values when the blade first flap frequency was in the region of two-per-revolution harmonic excitation. Calculated blade bending moment azimuthal distributions due to changes in cyclic pitch agreed well with experiment at radial stations near the blade root at values of the ratio of first flap frequency to rotor rotation rate from 1.5 to 5.0. At stations near the blade tip good agreement was only obtained at the higher values of frequency ratio. Author

N73-18035*# Lockheed-California Co., Van Nuys. Rotary Wing Div.
VIBRATION AND LOADS IN HINGELESS ROTORS. VOLUME 2: EXPERIMENTAL DATA
G. A. Watts and R. J. London Sep. 1972 272 p refs Sponsored in part by Army Air Mobility Res. and Develop. Lab. 2 Vol.
(Contract NAS2-5168)
(NASA-CR-114568) Avail: NTIS HC $15.75 CSCL 01C

Descriptions, geometry, and technical data covering three rotor systems are presented. Tables of experimental data gathered during wind tunnel testing of two of the systems are included. Both analyzed experimental data, ready for comparison with theory, and the basic reduced data from which they were obtained are reported. Author

N73-18036*# LTV Aerospace Corp., Hampton, Va.
A STUDY OF THE EFFECTS OF AEROELASTIC DIVERGENCE ON THE WING STRUCTURE OF AN OBLIQUE-WING SUPERSONIC TRANSPORT CONFIGURATION
Jan. 1973 17 p refs
(Contract NAS1-10900)
(NASA-CR-112262) Avail: NTIS HC $3.00 CSCL 01B

The aerodynamic characteristics of transport aircraft with oblique wing flying at supersonic speeds are discussed. Aeroelastic divergence of the forward swept portion of the wing is analyzed. The effect of aspect ratio as a method for avoiding aeroelastic divergence is examined. A relatively low aspect ratio appears necessary for an oblique wing when constructed of conventional aluminum alloy materials. The aspect ratio may be increased by increasing the wing thickness ratio and by utilizing materials with higher moduli of elasticity and rigidity. Author

N73-18037*# North Carolina State Univ., Raleigh.
A DESIGN STUDY FOR A SIMPLE-TO-FLY, CONSTANT ATTITUDE LIGHT AIRCRAFT
Frederick O. Smetana, Douglas E. Humphreys, Rafael J. Montoya, William W. Rickard, and Ivan E. Wilkinson Washington NASA Mar. 1973 322 p refs
(Grant NGR-34-002-086)
(NASA-CR-2208) Avail: NTIS HC $6.00 CSCL 01B

The activities during a four-year study by doctoral students to evolve in detail a design for a simple-to-fly, constant attitude light airplane are described. The study indicated that such aircraft could materially reduce the hazards to light airplane occupants which arise from the high pilot work load and poor visibility that occur during landing. Preliminary cost studies indicate that in volume production this system would increase the cost of the aircraft in roughly the same fashion that automatic transmission, power steering, power brakes, and cruise control increase the cost of a compact car. Author

N73-18038*# Boeing Co., Seattle, Wash.
CONCEPTUAL DESIGN STUDIES OF CANDIDATE V/STOL LIFT FAN COMMERCIAL SHORT HAUL TRANSPORT FOR 1980 - 1985 V/STOL LIFT FAN STUDY
W. M. Eldridge, J. A. Ferrell, J. W. McKee, J. E. Wayne, Jr., and J. M. Zabinsky Washington NASA Feb. 1973 100 p refs
(Contract NAS2-6563)
(NASA-CR-2183) Avail: NTIS HC $3.00 CSCL 01C

Conceptual designs of V/STOL lift fan commercial short haul transport aircraft for the 1980-85 time period were studied to determine their technical and economic feasibility. The engine concepts included both integral and remote fans. The scope of the study included definition of the hover control concept for each propulsion system, aircraft design, aircraft mass properties, cruise performance, noise and ride qualities evaluation. Economic evaluating was also studied on a basis of direct operating costs and route structure. Author

N73-18039*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF SUPERSONIC-TRANSPORT CONFIGURATIONS WITH LOW VALUES OF SONIC BOOM
James F. Dugan, Jr. Washington Mar. 1973 36 p refs

(NASA-TM-X-2746; E-6770) Avail: NTIS HC $3.00 CSCL 01C

A parametric study of low-boom supersonic transport airplanes with conventional configurations was made to identify the features of specific configurations that promise relatively low sonic boom overpressures (less than 47.9 N/sq m). The range of values considered was gross weight from 28,300 to 170,000 kg; cruise Mach numbers of 2 to 3.2; and wing loadings of 1436, 2870, and 4309 N/sq m. Fuselage length was varied from 49.1 to 102.4 m and fuselage diameter from 2.75 to 3.98 m. A nominal Mach 2 configuration weighing 56,700 kg and having a wing loading of 2870 N/sq m was selected; and its gross geometric, aerodynamic, and structural features were estimated. At a cruise altitude of 18,300 m, lift-drag ratio was estimated to be 7.35, while sonic boom overpressure was 41.7 N/sq m. Takeoff thrust loading using four afterburning turbojet engines at maximum dry thrust was 0.32. Payload for a 4440-km range was 16.7 percent of gross weight, giving a direct operating cost of 0.82 cents per seat / statute mile. Author

N73-18040*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ALUMINUM RUNWAY SURFACE AS POSSIBLE AID TO AIRCRAFT BRAKING

C. David Miller and I. Irving Pinkel Washington Mar. 1973 33 p refs

(NASA-TN-D-7186; E-7046) Avail: NTIS HC $3.00 CSCL 01E

Several concepts are described for use singly or in combination to improve aircraft braking. All involve a thin layer of aluminum covering all or part of the runway. Advantage would derive from faster heat conduction from the tire-runway interface. Heating of tread surface with consequent softening and loss of friction coefficient should be reduced. Equations are developed indicating that at least 99 percent of friction heat should flow into the aluminum. Preliminary test results indicate a coefficient of sliding friction of 1.4, with predictably slight heating of tread. Elimination of conventional brakes is at least a remote possibility. Author

N73-18041*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ACOUSTIC CHARACTERISTICS OF A SEMISPAN WING EQUIPPED WITH AN EXTERNALLY BLOWN JET FLAP INCLUDING RESULTS AT FORWARD SPEED

Michael D. Falarski Washington Mar. 1973 84 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

(NASA-TM-X-2749; A-4469) Avail: NTIS HC $3.00 CSCL 01B

A wind-tunnel investigation was made of the noise characteristics of a 14.5-ft semispan, externally blown jet flap model. The model was equipped with a single 30-in. diameter, ducted fan with a 1.03 pressure ratio. The effects of flap size, fan vertical location, and forward speed on the noise characteristics were studied. With the ducted fan mounted 0.79 or 1.24 diameters below the wing and a flap chord greater than 50 percent, the peak perceived noise level increased 2 to 3 Pndb when the flap was deflected to 90 deg. The jet scrubbing noise increased 3 to 4 db when the flap was deflected 90 deg. Installation of the fan on the wing was responsible for 1 to 2 db of this change. Forward speed did not have a significant effect on the perceived noise level, although it did cause a reduction in the sound pressure levels of the first and second fan harmonics. Author

N73-18042*# Michigan Univ., Ann Arbor.

A STUDY OF THE DYNAMIC TIRE PROPERTIES OVER A RANGE OF TIRE CONSTRUCTIONS

G. H. Nybakken, R. N. Dodge, and S. K. Clark Washington NASA Mar. 1973 35 p refs Revised

(Grant NGL-23-005-010)

(NASA-CR-2219; Rept-056080-19-T-Rev) Avail: NTIS HC $3.00 CSCL 01C

The dynamic properties of four model aircraft tires of various construction were evaluated experimentally and compared with available theory. The experimental investigation consisted of measuring the cornering force and the self-aligning torque developed by the tires undergoing sinusoidal steering inputs while operating on a small scale, road-wheel tire testing apparatus. The force and moment data from the different tires are compared with both finite- and point-contact patch string theory predictions. In general, agreement between finite contact patch theory and experimental observation is good. A modified string theory is also presented in which coefficients for cornering force and self-aligning torque are determined separately. This theory improves the correspondence between the experimental and analytical data, particularly on tires with relatively high self-aligning torques. Author

N73-18043# Sandia Labs., Albuquerque, N.Mex.

FLIGHT TEST EVALUATION OF FLUIDICALLY ACTUATED MONOPROPELLANT HYDRAZINE ROLL CONTROL SYSTEM

A. E. Hodapp, Jr. and R. C. Beckmann 1972 67 p refs Presented at 2d Atmospheric Flight Mech. Conf., Moffett Field., Ga., 11 Sep. 1972 Sponsored by AEC

(SC-DC-722244(RD); Conf-720921-1) Avail: NTIS

A reentry vehicle roll control system, with base plane thrusters and fluidic control logic, was flight tested at supersonic speeds through a simulated low altitude resonance encounter. Roll torque producing asymmetries were built into the 10 deg conical test vehicle so that, without roll control, persistent resonance would occur. Flight test results confirmed analytical predictions. They show that the control system maintained roll control and that system operation remained stable. Separation - induced changes in static stability and drag were larger than expected. These undesirable effects, caused by thruster exhaust, can be eliminated with a shroud. Author

N73-18044# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

RESULTS AND KNOWLEDGE GAINED IN AERODYNAMIC JET INTERFERENCE FROM THE VSTOL JET TRANSPORT AIRCRAFT DO 31 AND THEIR APPLICATION TO FUTURE VSTOL DEVELOPMENTS [ERGEBNISSE UND ERFAHRUNGEN ZUR AERODYNAMISCHEN STRAHLINTERFERENZ BEIM VSTOL-STRAHLTRANSPORTFLUGZEUG DO 31 UND IHRE ANWENDUNG AUF ZUKUENFTIGE VSTOL-ENTWICKLUNGEN]

Dieter Welte Bonn Bundeswehramt 1972 183 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-72-22) Avail: NTIS HC $11.25; Bundeswehramt 25 DM

The most important results concerning jet interference effects for the Do-31 aircraft, resulting from wind tunnel model measurements and flight tests, are presented, and an estimation is given of jet interference effects for future VSTOL project studies. Calculations are based on a single semi-empirical method for determination of jet-induced lift-loss in hovering for simple configurations such as the Do-31, and it is possible to calculate the lift-loss to within 1 percent accuracy. The investigation of the jet-induced flow field around the Do-31 during hovering with ground effect and in the transition flight regime yielded a rough estimation of the jet interference effects for future VSTOL studies. ESRO

N73-18045# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

SOUND RADIATION IN THE SHORT AND LONG RANGE OF THE VSTOL JET TRANSPORT AIRCRAFT DO 31 AND NOISE REDUCTION POSSIBILITIES FOR FUTURE V/STOL DEVELOPMENTS [SCHALLABSTRAHLUNG IM NAH- UND FERNFELD DES VSTOL-STRAHLTRANSPORTERS DO 31 UND LAERMMINDERUNGSMOEGLICHKEITEN BEI ZUKUENFTIGEN VSTOL-ENTWICKLUNGEN]

Peter Bartels Bonn Bundeswehramt 1972 167 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-72-23) Avail: NTIS HC $10.50; Bundeswehramt 25 DM

Results of theoretical and experimental investigations of noise in the near and far field of the VSTOL jet transport aircraft Do 31 are presented in condensed form. Particular attention was given to the problem of aircraft noise reduction in the vicinity of existing airports, which is already possible with the Do 31, and to the noise and noise reduction of existing and future VSTOL concepts. The high flexibility in the selection of flight

procedures makes the VSTOL aircraft the only vehicle adaptable to local circumstances. This is important not only from a military point of view, but more generally for optimal economy and noise reduction. Author (ESRO)

N73-18046# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

THE DO 31 LANDING LOADS DURING VERTICAL LANDING AND THEIR CONSEQUENCES FOR FUTURE VSTOL DEVELOPMENTS [DIE LANDELASTEN DER DO 31 BEI VERTIKALLANDUNGEN UND FOLGERUNGEN FUER ZUKUENFTIGE VSTOL-ENTWICKLUNGEN]

Wolfgang Schoernack Bonn Bundeswehramt 1972 72 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-72-24) Avail: NTIS HC $5.75; Bundeswehramt 25 DM

The results of 83 vertical landings carried out during the Do 31 VSTOL Experimental Program are reported. During 23 landings, undercarriage reactions, as well as sinking speeds were measured; of the remaining 60 landings only sinking speeds could be evaluated. Undercarriage reaction factors and sinking speeds are plotted as frequency distributions and discussed. The result of the evaluation of the landing experiments can be summarized as follows: VTOL airplanes of a conception similar to the Do 31 and using manual control during the end of descent would experience considerably higher sinking speeds than conventional aircraft. Furthermore, a typical jumping of the airplane after touchdown and a following second impact prove unfavorable, this second impact resulting in higher undercarriage reactions than the first one. The horizontal loads occurring with vertical landings are smaller than expected. Author (ESRO)

N73-18047# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.

AN INVESTIGATION OF AIRBORNE DISPLAYS AND CONTROLS FOR SEARCH AND RESCUE (SAR). VOLUME 6: AVIONICS REQUIREMENTS FOR THE HH-53C HELICOPTER Final Report, Sep. 1971 - Jan. 1972

O. Herbert Lindquist, B. A. Olson, A. Jones, and James W. Wingert May 1972 103 p refs

(Contract N00014-69-C-0406; NR Proj. 213-072)

(AD-752625; HONEYWELL-12609-FR1-Vol-6; JANAIR-720902-Vol-6) Avail: NTIS CSCL 06/7

An analytical study was conducted to define the avionics system and the display and controls concept required for the HH-53C helicopter so that it could accomplish the USAF's all-weather SAR mission. The study tasks included development of an avionics concept based on a representative mission scenario, avionics and sensor package selection, a man/machine function allocation and crew workload analysis. A recommended avionics configuration was defined. The HH-53C can be upgraded by an avionics configuration, within the cost constraints, to perform the all-weather SAR mission. This upgraded HH-53C can be operated by the crew within their workload limitations.

Author (GRA)

N73-18048# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF THE OPTIMUM REVERSING COEFFICIENT OF THRUST REVERSALS FOR THE ENGINES OF PASSENGER AIRCRAFT

A. G. Gilerson 7 Nov. 1972 11 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Kazan), no. 127, 1970 p 28-34

(AD-752814; FTD-MT-24-1482-72) Avail: NTIS CSCL 01/2

A simple empirical method is proposed for determining the overall required negative thrust and the required coefficient of reversal based on average statistical data on the magnitude of the reversible thrust capacity (ratio of the overall thrust of the reverser to the weight of the aircraft) of modern passenger airplanes with thrust reverser. This ratio for various types of aircraft ranges from 0.24 to 0.30 (the larger figures apply to number of engines with thrust reverser as a function of the coefficient of reversal). Author (GRA)

N73-18049# Naval Aerospace Medical Research Lab., Pensacola, Fla.

MAJOR ORIENTATION-ERROR ACCIDENTS IN REGULAR ARMY UH-1 AIRCRAFT DURING FISCAL YEAR 1969: ACCIDENT FACTORS

W. Carroll Hixson, Jorma I. Niven, and Emil Spezia Oct. 1972 39 p refs Prepared in cooperation with Army Aeromed. Res. Lab., Fort Rucker, Ala.

(MF51524005)

(AD-753208; NAMRL-1169; USAARL-73-2) Avail: NTIS CSCL 01/2

The report is the third dealing with pilot disorientation/vertigo problem in Regular Army UH-1 helicopter operations. Individual case history data extracted from the USABAAR master aircraft accident files are presented on 44 major orientation-error accidents that occurred in UH-1 aircraft during fiscal year 1969. Summary data listings involving a variety of operational and pilot-related accident factors are presented for each of the cases.

Author (GRA)

N73-18050# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

PRELIMINARY DESIGN AND COST STUDY OF RECIRCULATING CHROMATE RINSE SYSTEM FOR AIRCRAFT CORROSION CONTROL

K. G. Clark and W. C. Hallow 2 Nov. 1972 20 p refs

(AD-753214; NADC-72183-VT) Avail: NTIS CSCL 01/3

Aircraft rinse facilities are presently employed to remove corrosive salt deposits from aircraft operating in salt laden environments. While water rinsing has been effective in reducing corrosion, the rate of attack can be further reduced by introducing a small amount of corrosion inhibitor, such as potassium dichromate, into the rinse water. The report presents a preliminary design and cost study for such a recirculating chromate rinse system. GRA

N73-18051# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.

A NUMERICAL SOLUTION FOR AN UNSTEADY TWO-DIMENSIONAL JET-FLAPPED WING

Glen E. Potter Nov. 1972 81 p refs

(Grant DA-ARO(D)-31-124-G13)

(AD-752928; AROD-9334-1-E) Avail: NTIS CSCL 01/3

A numerical solution of the two-dimensional jet-flapped airfoil utilizing discrete vortices to represent airfoil and jet vortex distributions is presented for two time-dependent cases. The first concerns an instantaneous deflection of the jet exit angle and the second case involves continuous oscillation of the jet angle. Author (GRA)

N73-18052# Naval Air Development Center, Warminster, Pa. Systems Analysis and Engineering Dept.

OPTIMAL CONTROL OF THE F-8C IN A FULLY AUTOMATIC CARRIER APPROACH Final Report

Roger J. Bannett 7 Nov. 1972 142 p refs

(AD-753010; NADC-SD-7153) Avail: NTIS CSCL 01/2

The report presents a detailed exposition of the problems associated with landing high performance jet fighter aircraft on board a moving aircraft carrier along with a new procedure for designing a fully automatic flight control system tailored to the aircraft carrier approach. Included in the development is a brief description of the present SPN-42 ACLS (Aircraft Carrier Landing System) and the probable reason for its very limited success. Possible alternatives to the SPN-42 system have suggested a more sophisticated ACLS configuration, in particular, the AMOAC (Automatic Multiloop Optimal Approach Controller) developed herein. The use of an AMOAC system in actual carrier approaches should yield a substantial improvement to present automatic carrier landing capability. Author (GRA)

N73-18053# United Aircraft Corp., East Hartford, Conn. Research Labs.

INVESTIGATION OF AIRFOIL DYNAMIC STALL AND ITS INFLUENCE ON HELICOPTER CONTROL LOADS Final Report

Franklin O. Carta, Gerald L. Commerford, Raymond G. Carlson, and Robert H. Blackwell Sep. 1972 209 p refs

(Contract DAAJ02-71-C-0003; DA Proj. 1F1-62204-A-139)

(AD-752917; USAAMRDL-TR-72-51) Avail: NTIS CSCL 01/3

Measurements were made of the unsteady normal force and

pitching moment on an NACA 0012 airfoil model oscillated both sinusoidally and nonsinusoidally over a range of incidence angles, including a substantial penetration into stall. The sinusoidal normal force and pitching moment data were reduced and tabulated as functions of the angle of attack, the angular velocity parameter, and the angular acceleration parameter. This generalized form of the data was used to reconstruct the measured sinusoidal aerodynamic response of the model airfoil with excellent results. Additional correlations were made using nonsinusoidal pitch schedules which included periodic ramp changes in angle of attack and a flexured angular blade response to a one-per-rev sinusoidal incidence angle change typical of that for a helicopter blade. The agreement between predicted and measured normal force and moment loops was very good for the ramp motion.
Author (GRA)

N73-18054# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLOW AROUND WING PROFILE WITH THE PRESENCE ON THE SURFACE OF A SYSTEM OF SOURCES AND SINKS
B. S. Baev and V. N. Zhuravlev 20 Oct. 1972 12 p refs
Transl. into ENGLISH of Teplo- i Massoperenos (USSR), no. 12, 1969 p 383-386
(FTD Proj. T70-01-12)
(AD-752686; FTD-HT-23-834-72) Avail: NTIS CSCL 01/3

The article examines the determination of aerodynamic characteristics during flow around a profile by a plane-parallel flow of an incompressible, ideal fluid for the following arrangements: a sink and source in a single plane; a sink and source in different planes; a sink on the upper surface. The solution is carried out by applying the theory of the function of a complex variable and by the method of the conformal transformation of a unit circle onto the profile.
Author (GRA)

N73-18055# Schjeldahl (G. T.) Co., Northfield, Minn. Advanced Programs Div.
DESIGN AND MANUFACTURE OF A 670,000 CUBIC FOOT NATURAL SHAPE BALLOON FOR PROJECT POBAL Final Report, Oct. 1971 - Aug. 1972
James B. Munson 15 Sep. 1972 62 p refs
(Contract F19628-72-C-0108)
(AD-753086; SER-0159; AFCRL-72-0614) Avail: NTIS CSCL 01/3

The configuration and manufacture of a 670,000 cubic foot, natural shape, zero pressure, free flight balloon is described. Requirements, design calculations, documentation, fabrication, testing and inspection are discussed.
Author (GRA)

N73-18056# Environmental Health Lab., Kelly AFB, Tex.
NOISE SURVEY, F-105 OVERFLIGHTS, WICHITA MOUNTAINS WILDLIFE REFUGE AND VICINITY, FORT SILL, OKLAHOMA
Alvin R. Frazier Sep. 1972 70 p refs
(AD-753113; EHL(K)-72-21) Avail: NTIS CSCL 06/6

A noise survey quantitated the environmental noise levels which would be produced by F-105 aircraft flights over the Quanah Weapons Range located on Fort Sill. Data were obtained at a nearby Job Corp Center, Camp Boulder located on the adjoining Wichita Mountains Wildlife Refuge and the cities of Cache and Indiahoma. Adverse effects on the environment are predicted to be minimal and serious interference with present or future land uses is not expected. After serious consideration of many factors, the benefits to be gained through the proposed joint use of this existing artillery range outweigh the minimal adverse effects that would develop because of the flyby noise.
Author (GRA)

N73-18057# Logistics Management Inst., Washington, D.C.
OPTIMUM SERVICE LIFE DETERMINATION TECHNIQUE
Nov. 1972 70 p refs
(Contract SD-271; SD Proj. 271-168)
(AD-752747; LMI-72-12) Avail: NTIS CSCL 01/3

The report describes efforts by LMI to determine feasible methods of attaining the following dual interrelated objectives: to improved long-range predictions of the safe remaining structural life of groups of Naval aircraft (e.g., all Navy F-4Bs) to be used statistically to facilitate and support decisions regarding major structural modification programs, programmed aircraft model service life and service life extensions, and planning of the future military role to be filled by given aircraft models, and to improved short-range predictions of the structural condition of individual Naval aircraft, which can be used to develop a maintenance strategy (e.g., inspection intervals) which would increase the probability of aircraft meeting operational commitments without major structural problems.
Author (GRA)

N73-18058# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.
UH-1 TEST BED PROGRAM, VOLUME 1 Final Report
Robert R. Butcher, Russell Kirby, Jr., John Nakakihara, and T. C. Watkins Jun. 1972 418 p refs
(Contract DAAJ01-70-C-0828; DA Proj. 1F1-64204-DC-32)
(AD-752890; NORT-71-293A-Vol-1;
USAAVSCOM-TR-72-19-Vol-1) Avail: NTIS CSCL 01/3

The UH-1H helicopter test bed program was accomplished at the U.S. Army Aeronautical Depot Maintenance Center (ARADMAC), Corpus Christi, Texas, during the period 4 October 1970 through 17 December 1971. The program objective was to determine the capability of state-of-the-art hardware to automatically accomplish inspection, diagnostic and prognostic maintenance functions on selected subsystems of the UH-1H helicopter. Northrop's hardware for the program is identified as a Maintenance Reporting System (MRS). Helicopter components, both serviceable and degraded, were run and monitored for malfunction discrimination by the MRS in ARADMAC test cells and in two UH-1H aircraft. Trending for prognosis was attempted while accumulating flight time on two additional UH-1H aircraft utilizing serviceable components. The test results demonstrated the objectives of the test bed program.
Author (GRA)

N73-18059# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.
UH-1 TEST BED PROGRAM, VOLUME 2 Final Report
Robert R. Butcher, Russell Kirby, Jr., John Nakakihara, and T. C. Watkins Jun. 1972 111 p
(Contract DAAJ01-70-C-0828)
(AD-752891; NORT-72-220A-Vol-2;
USAAVSCOM-TR-72-19-Vol-2) Avail: NTIS CSCL 01/3

The document presents accomplishments during Phase E of the UH-1H Helicopter Test Bed Program for an Automatic Inspection, Diagnostic and Prognostic System conducted at the U.S. Army Aeronautical Depot Maintenance Center (ARADMAC), Corpus Christi, Texas, from 1 October 1971 through 17 December 1971.
Author (GRA)

N73-18060# Hamilton Standard, Windsor Locks, Conn.
UH-1H AIDAPS TEST BED PROGRAM, VOLUME 1 Final Report, 4 Oct. 1970 - 17 Dec. 1971
James Provenzano, John Games, Al Wyrostek, Art Ostheimer, and Jack Young 31 Aug. 1972 347 p
(Contract DAAJ01-70-C-0827; DA Proj. 1F1-64204-DC-32)
(AD-752893; HSER-6080-Vol-1;
USAAVSCOM-TR-72-18-Vol-1) Avail: NTIS CSCL 01/3

The UH-1H helicopter Test Bed Program was accomplished at the U.S. Army Aeronautical Depot Maintenance Center, Corpus Christi, Texas, during the period 4 October 1970 through 17 December 1971. The program objective was to determine the feasibility of state-of-the-art hardware to automatically accomplish inspection, diagnostic and prognostic maintenance functions on selected subsystems of the UH-1H helicopter. The Hamilton Standard hardware for the program is identified as Airborne Integrated Diagnostic System (AIDS). Helicopter components, both serviceable and degraded, were run and monitored for malfunction discrimination by the AIDS in ARADMAC test cells and in two UH-1H aircraft. Trending for prognosis was attempted while accumulating flight time on two additional UH-1H aircraft utilizing serviceable components.
Author (GRA)

N73-18061# Hamilton Standard, Windsor Locks, Conn.
UH-1H AIDAPS TEST BED PROGRAM, VOLUME 2 Final Technical Report
James Provenzano, John Games, Al Wyrostek, Art Ostheimer, and Jack Young Aug. 1972 345 p
(Contract DAAJ01-70-C-0827; DA Proj. 1F1-64204-DC-32)
(AD-752894; HSER-6080-Vol-2;

USAAVSCOM-TR-72-18-Vol-2) Avail: NTIS CSCL 01/3

The report contains a description of airborne checkout sensors, their installation points, and their checkout parameters. Included is a computer aided analysis of the checkout procedures and results obtained. GRA

N73-18062# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS). VOLUME 1: SUMMARY Final Report

Sep. 1972 72 p refs

(Contract DAAJ01-71-C-0503)

(AD-752882; NORT-71-292A-Vol-1;

USAAVSCOM-TR-72-20-Vol-1) Avail: NTIS CSCL 01/3

The report presents the results of a concept formulation study for an Automatic Inspection, Diagnostic and Prognostic System (AIDAPS) for Army aircraft. The purpose of the study was to satisfy the prerequisites of contract definition as defined in the life cycle management model for Army systems. The study results conclusively demonstrate that these prerequisites were satisfied. Author (GRA)

N73-18063# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS). VOLUME 2: AIDAPS DESIGN AND TRADE STUDIES Final Report

Sep. 1972 623 p

(Contract DAAJ01-71-C-0503)

(AD-752883; NORT-71-292A-Vol-2;

USAAVSCOM-TR-72-20-Vol-2) Avail: NTIS CSCL 01/3

The objective of this study is to determine the most cost effective approach to the Army requirement for an Automatic Inspection Diagnostic and Prognostic System (AIDAPS). The system must automatically diagnose mechanical malfunctions, warn of impending mechanical failures, and eliminate unnecessary inspections or part removals. It must also permit the change of aircraft components on an on-condition basis instead of a time change basis. The ultimate goals of the program are to reduce aircraft life cycle ownership costs, increase aircraft availability and improve aircraft safety. Author (GRA)

N73-18064# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS). VOLUME 3: TECHNICAL PROPOSAL RECOMMENDED DEVELOPMENT PLAN Final Report

Sep. 1972 128 p

(Contract DAAJ01-71-C-0503)

(AD-752884; NORT-71-292A-Vol-3;

USAAVSCOM-TR-72-20-Vol-3) Avail: NTIS CSCL 01/3

The report presents a proposed plan for the development and deployment of the Universal Modular AIDAPS prepared in accordance with the Army Data Item, DI-S-1803. The end items of the systems are defined; work breakdowns, milestone schedules and PERT networks are given for the development efforts. Schedules and PERT networks for the adaptation, data collection, operational testing and deployment for all the aircraft types which are included are suggested; an AIDAPS maintenance plan and a product assurance plan are submitted; development costs and costs for ten years beyond project go-ahead are tabulated; an Integrated Logistics Support plan is suggested; development documentation requirements and schedules for submittal are established; and the anticipated duties, tasks and capabilities of AIDAPS-related Army personnel are discussed. Author (GRA)

N73-18065# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS). VOLUME 4: AIDAPS GENERAL SPECIFICATION Final Report

Sep. 1972 29 p

(Contract DAAJ01-71-C-0503)

(AD-752885; NORT-71-292A-Vol-4;

USAAVSCOM-TR-72-20-Vol-4) Avail: NTIS CSCL 01/3

The specification establishes the technical and mission requirements for the Automatic Inspection, Diagnostic and Prognostic System (AIDAPS) as an entity, allocates requirements to functional areas, and defines the interfaces between or among the functional areas. This specification is based on parameters developed during the concept formulation phase and shall be used to establish the general nature of the AIDAPS to be further defined during the development phase. Author (GRA)

N73-18066# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS). APPENDIX C: AIDAPS COMPUTER MODELS Final Report

Sep. 1972 157 p

(Contract DAAJ01-71-C-0503)

(AD-752886; NORT-71-292-App-C;

USAAVSCOM-TR-72-20-App-C) Avail: NTIS CSCL 01/3

The appendix presents the computer models developed to perform the AIDAPS Concept Formulation Study Program. The three models used are the AIDAPS Procurement Cost Model, AIDAPS/Aircraft Maintenance Analysis Model, and the AIDAP System Cost Benefit Model. The AIDAPS Procurement Cost Model is utilized to compute the cost factors used to calculate the cost of implementing AIDAPS into the Army system which includes all substantial initial investment and ownership costs. The AIDAPS/Aircraft Maintenance Analysis Model is used to calculate the effectiveness achieved by AIDAPS application. The AIDAP System Cost Benefit Model computes AIDAPS life cycle costs, cost savings, and benefits derived from using AIDAPS, and develops the net savings and benefits. Author (GRA)

N73-18067# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS). APPENDIX D: COMPUTER OUTPUT DATA Final Report

Sep. 1972 381 p

(Contract DAAJ01-71-C-0503)

(AD-752887; NORT-71-292-App-D;

USAAVSCOM-TR-72-20-App-D) Avail: NTIS CSCL 01/3

The computer runs used in the AIDAPS tradeoffs are included in this appendix. These runs were programmed according to the model discussed in Appendix C, AIDAPS/Aircraft Computer Models. Section 1 contains computer printouts for the Unique AIDAPS configurations for each of the aircraft. Section 2 contains the computer runs for the Group and Universal AIDAP systems. An explanation of the information contained in each of the four distinctive printouts is presented here. A sample of each of the four printouts, numbered in accordance with the following discussion, is included. Author (GRA)

N73-18068# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS). APPENDIX E: UH-1 MAINTENANCE DATA TABULATIONS Final Report

Sep. 1972 727 p

(Contract DAAJ01-71-C-0503)

(AD-752888; NORT-71-292-App-E;

USAAVSCOM-TR-72-20-App-E) Avail: NTIS CSCL 01/3

Computer tabulations reflecting the maintenance history as reported under The Army Maintenance Management System (TAMMS), formerly (TAERS), for the aircraft being considered are presented in this report. These tabulations provide the reported maintenance requirements at Organizational, Direct Support (DS), General Support (GS) and Depot levels of maintenance. Author (GRA)

N73-18069# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS

(AIDAPS). APPENDIX F: AIDAPS PARAMETER LISTS Final Report
Sep. 1972 66 p
(Contract DAAJ01-71-C-0503)
(AD-752889; NORT-71-292-App-F;
USAAVSCOM-TR-72-20-App-F) Avail: NTIS CSCL 01/3

A Concept Formulation Study to determine the impact of AIDAPS on the maintenance of selected Army aircraft has been performed. The Study was conducted in three phases. In Phase A the feasibility of the AIDAPS concept was confirmed; in Phase B practical AIDAP Systems were identified and cost effectiveness mathematical models were formulated; and in Phase C the models were operated and using Army maintenance and cost data, the optimum AIDAPS configurations and the potential life-cycle cost savings as a result of the application of AIDAPS were determined. The Study showed that the combat effectiveness of Army aircraft can be increased through the application of Modular Universal AIDAPS and that its use will be overwhelmingly life-cycle cost effective for the AH-1, UH-1, OV-1, CH-47 and CH-54 type aircraft. Combat effectiveness will be increased for the U-21, OH-6 and OH-58 type aircraft but AIDAPS will not provide sufficient return on investment to be considered cost effective. Author (GRA)

N73-18070# Boeing Co., Philadelphia, Pa. Vertol Div.
AN INVESTIGATION OF NOISE GENERATION ON A HOVERING ROTOR, PART 2 Final Report, 1 Feb. 1971 - 31 Jul. 1972
H. Sternfeld, C. Bobo, D. Carmichael, T. Fukushima, and R. Spencer
Nov. 1972 107 p refs
(Contract DAHC04-69-C-0087)
(AD-753397; D210-10550-1-Pt-2; AROD-8704-3-E-Pt-2) Avail: NTIS CSCL 20/1

The study is a natural extension of the program to investigate noise generation on a hovering rotor reported in a previous investigation. That program acquired data on a large (60 ft.) diameter rotor operating on a whirl tower, and evaluated that data in the light of established analytical procedures. The work described in this report compares available data in order to investigate the effects of variations in rotor design. This data which was available from other test programs included variations in number of blades of similar airfoil, airfoil, and platform. Also included is an evaluation of model testing by comparison of the results of the full size helicopter rotor with a one-eleventh scale model. Author (GRA)

N73-18071# Army Aviation Systems Test Activity, Edwards, AFB, Calif.
FLIGHT EVALUATION ELLIOTT LOW-AIRSPEED SYSTEM Final Report, 21 Jun. - 15 Nov. 1971
Albert L. Winn and James S. Kishi Sep. 1972 39 p refs
(AD-753343; USAASTA-71-30; FR-1) Avail: NTIS CSCL 01/4

Airspeed calibration tests were conducted on an experimental model of the Elliott low-airspeed system to determine its suitability for use as a helicopter airspeed instrument. The airspeed system was mounted in various locations on the UH-1C helicopter. Emphasis was placed on the low-speed flight regimes where the sensor operated in rotor downwash. The evaluation required 13.7 productive test flight hours. The system provides reliable, accurate airspeed data from hover to 120 knots in the direction for which the sensor is mounted, and results indicate an omnidirectional system is feasible. The system is simple, is highly reliable, should be relatively inexpensive in production quantities, and has high potential for development into a standard aircraft instrument. Author (GRA)

N73-18072# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
STUDY OF IMPULSIVE SOUND GENERATED BY ROTOR TIPS ACCELERATING NEAR THE SONIC SPEED Final Report, 25 Jun. 1969 - 24 Jun. 1971
Richard H. Lyon 1 Nov. 1972 23 p Revised
(AD-752301; AROD-8705-2-E) Avail: NTIS CSCL 20/1

The principal results obtained are summarized as follows: Compressibility effects at the rotor tip during high speed forward flight are an important noise source. An acoustical model appears to give reasonable predictions of observed sound levels and directionality. Thickness radiation generally dominates lift radiation. By modifying the tip planform, section, and chord, sound level reductions can be achieved of the order of 10 db or more. The thickness distributions as derived appear sufficiently smooth so that they should be aerodynamically well behaved. Author (GRA)

N73-18073# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
A SYSTEMS STUDY OF NOISE REQUIREMENTS AND EXPERIMENTAL INVESTIGATION OF NOISE SOURCES FOR V/STOL AIRCRAFT Final Report, 24 Jun. 1969 - 23 Jun. 1972
Robert W. Simpson Sep. 1972 13 p refs
(Contract DAHC04-69-C-0086)
(AD-752447; AROD-8713-3-E) Avail: NTIS CSCL 01/3

The report presents a summary of the problems studied and the results and conclusions reached in an investigation of the effect of noise problems and constraints on V/STOL aircraft design and operation, with the emphasis on helicopters. Author (GRA)

N73-18074# Naval Postgraduate School, Monterey, Calif.
EXPLORATORY STUDY OF THE TURNING CHARACTERISTICS OF A COANDA-OPERATED JET FLAP M.S. Thesis
James Houston Blakeney Sep. 1972 76 p refs
(AD-753618) Avail: NTIS CSCL 01/3

An exploratory investigation of the jet deflection characteristics of a jet-flapped airfoil with Coanda deflection surfaces was performed. Velocity distribution and flow angle measurements were made with the jetflap in static operation. Flow visualization tests were used to determine the turning characteristics in incompressible flow. Author (GRA)

N73-18075# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
COLLECTION AND ANALYSIS OF SINK SPEED DATA AS PART OF THE X-22A FLIGHT RESEARCH PROGRAM Final Report
John L. Beilman 15 Nov. 1972 38 p
(Contract N00019-71-C-0044)
(AD-753852; CAL-TB-3011-F-1) Avail: NTIS CSCL 01/3

Very little experimental data exists on the landing impact loads encountered during landings of V/STOL airplanes. Development of criteria for predicting these loads has been initiated with the collection of data on the X-22A flight research program. Special instrumentation has been installed in the X-22A to measure sink rate data during landing approaches. The instrumentation was calibrated before and during the flight tests. Data was obtained for 31 landings, and statistical analyses were performed. Because of the small number of landings involved in this program, a firm statistical data base cannot be obtained, but certain trends are apparent. Histograms of the pertinent parameters are presented to show these trends, and tables of data obtained for each flight are included. Author (GRA)

N73-18076# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF STABILITY AND CONTROL CHARACTERISTICS OF AC130 LINEAR MODELS M.S. Thesis
Robert G. Lorenz Mar. 1972 92 p refs
(AD-753388; GAM/AE/72-5) Avail: NTIS CSCL 01/4

Mathematical models of the AC130A and AC130E aircraft are proposed. The models are developed from linearized equations and are referred to trim conditions of level turning flight. The proposed AC130E model is compared to an existing model to ascertain whether any significant differences exist between the two. A qualitative comparison is conducted by investigating each model's response to control deflections. The proposed AC130A model is used to predict general trends and probable values for stability derivatives and selected mode parameters over an extensive flight envelope. Author (GRA)

N73-18077# Hughes Tool Co., Culver City, Calif. Aircraft Div.
OH-6A PHASE 2 QUIET HELICOPTER PROGRAM Final Report, Apr. 1970 - Apr. 1971
William H. Barlow, William C. McCluskey, and Harold W. Ferris
Sep. 1972 69 p refs
(Contract DAAJ02-69-C-0078; ARPA Order 1321)
(AD-753646; HTC-AD-71-102; USAAMRDL-TR-72-29) Avail:

NTIS CSCL 01/3

The report presents the results of the Phase 2 Quiet Helicopter Program. A Hughes OH-6A Light Observation Helicopter was extensively modified to obtain a maximum of quieting. The purpose was to apply the latest known sound-suppression techniques available to industry to an actual helicopter and then to measure the results. An acoustic goal was set which required a balanced treatment of each noise-producing source throughout the full frequency range. Noise reductions ranged from 14 to 20 db depending on the flight conditions. The report describes the detailed configuration changes, the test and development programs, and the final sound level measurements compared to the standard OH-6A. Author (GRA)

N73-18879* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

APOLLO 15 MAIN-PARACHUTE FAILURE

Donald D. Arabian and Joseph E. Mechelay *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 137-148 (For availability see N73-18866 09-31)

CSCL 01C

N73-18890* Kaman Aerospace Corp., Bloomfield, Conn.

A FLYING EJECTION SEAT

R. H. Hollrock and J. J. Barzda *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 275-286 (For availability see N73-18866 09-31)

CSCL 06G

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-18078*# General Electric Co., Schenectady, N.Y. Physical Chemistry Lab.

STUDY, SELECTION, AND PREPARATION OF SOLID CATIONIC CONDUCTORS Final Report, 1 Jul. 1971 - 30 Jun. 1972

W. L. Roth, S. P. Mitoff, and R. N. King Sep. 1972 69 p refs

(Contract NAS3-15692)

(NASA-CR-120964; SRD-72-116) Avail: NTIS HC $5.50 CSCL 10C

Crystal chemical principles and transport theory were used to predict structures and specific compounds which might find application as solid electrolytes in rechargeable high energy and high power density batteries operating at temperatures less than 200 C. More than twenty compounds were synthesized or obtained and screened by nuclear magnetic resonance and conductivity. Many were densified by sintering or hot pressing. Encouraging results were obtained for nine of these materials but none have yet been good ionic conductors at low temperature. Author

N73-18079*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DETERMINATION AND EVALUATION OF PERFORMANCE LIMIT CRITERIA OF FAST-RESPONSE ELECTROHYDRAULIC SERVOSYSTEMS

John R. Zeller and John A. Webb, Jr. Washington Mar. 1973 30 p refs

(NASA-TM-X-2736; E-7239) Avail: NTIS HC $3.00 CSCL 09E

Limit criteria for determining the dynamic performance capabilities of high performance, fast-response (greater than 100 Hz) electrohydraulic servosystems are presented. A detailed analysis of the maximum load locus of these systems is used as a basis for the derivation of improved limit criteria. These criteria predict the maximum performance limits caused by system nonlinearities and physical limitations. The criteria are applied to experimental data to verify their validity. Design criteria which assist in the selection of system components for optimal performance are also discussed. Author

N73-18080*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MOTOR STARTING A BRAYTON CYCLE POWER CONVERSION SYSTEM USING A STATIC INVERTER

Joseph S. Curreri, Richard A. Edkin, and Roman Kruchowy Washington Mar. 1973 19 p refs

(NASA-TM-X-2738; E-7252) Avail: NTIS HC $3.00 CSCL 09E

The power conversion module of a 2- to 15-kWe Brayton engine was motor started using a three-phase, 400-hertz static inverter as the power source. Motor-static tests were conducted for initial gas loop pressures of 10, 14, and 17 N/sq cm (15, 20, and 25 psia) over a range of initial turbine inlet temperatures from 366 to 550 K (200 to 530 F). The data are presented to show the effects of temperature and pressure on the motor-start characteristics of the rotating unit. Electrical characteristics during motoring are also discussed. Author

N73-18081# Advisory Group for Aerospace Research and Development, Paris (France).

TECHNICAL EVALUATION REPORT ON 39TH PROPULSION AND ENERGETICS PANEL MEETING ON ENERGETICS FOR AIRCRAFT AUXILIARY POWER SYSTEMS

R. H. Johnson (AFAPL), C. E. Oberly (AFAPL), and R. E. Quigley, Jr. (AFAPL) Nov. 1972 11 p refs Conf. held at Colorado Springs, 12-15 Jun. 1972

(AGARD-AR-50) Avail: NTIS HC $3.00

An evaluation of a conference to discuss current and future developments in aircraft electrical and auxiliary power systems is presented. Superconductivity phenomena as related to power generation are emphasized. The anticipated requirements imposed on weight, volume, and performance of auxiliary power systems which must operate in a high temperature environment are analyzed. Author

N73-18082*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL TEST RESULTS OF A GENERALIZED PARAMETER FUEL CONTROL

Peter G. Batterton and Harold Gold Washington Mar. 1973 29 p refs

(NASA-TN-D-7198; E-7254) Avail: NTIS HC $3.00 CSCL 21D

Considerable interest has been generated recently in low cost jet propulsion systems. One of the more complicated components of jet engines is the fuel control. Results of an effort to develop a simpler hydromechanical fuel control are presented. This prototype fuel control was installed on a J85-GE-13 jet engine. Results show that the fuel control provided satisfactory engine performance at sea level static conditions over its normal nonafterburning operating range, including startup. Results of both bench and engine tests are presented; the difficulties encountered are described. Author

N73-18083*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IMPROVEMENTS IN AND TEST RESULTS FOR THE 2 TO 15 KILOWATT BRAYTON CYCLE ELECTRICAL SUBSYSTEM

James E. Vrancik and Richard C. Bainbridge Washington Mar. 1973 21 p refs

(NASA-TM-X-2757; E-7260) Avail: NTIS HC $3.00 CSCL 10A

The electrical subsystem of the 2- to 15-kW Brayton power conversion system consists of the auxiliary electrical equipment required for an integrated, self-contained system. For the last 2 years the electrical subsystem has been undergoing extensive tests. The first year of testing resulted in determining the performance characteristics of the electrical subsystem. During the second year several significant changes and improvements were investigated. An inverter designed for motor starting the alternator performed successfully. Some of the changes that have been made are a new alternator speed pickup, which is independent of the alternator output voltage; new, more efficient power supplies for the control system; and a volts-per-hertz reference for the alternator voltage regulator. Test data were taken on the temperature distribution of the electrical subsystem at startup conditions over a cold-plate temperature range of 25 to -50 C. Author

N73-18084*# Westinghouse Electric Corp., Lima, Ohio.
DEVELOPMENT AND EVALUATION OF MAGNETIC AND ELECTRICAL MATERIALS CAPABLE OF OPERATING IN THE 800 TO 1600 F TEMPERATURE RANGE
P. E. Kueser and J. W. Toth Washington NASA Mar. 1973 32 p refs
(Contract NAS3-6465)
(NASA-CR-2224; WAED-68.05E; E-7312) Avail: NTIS HC $3.00 CSCL 09A

The results are summarized of a research program on electrical materials for advanced space electric power systems. The areas investigated included improved high-temperature magnetic materials, high-temperature capacitor materials, ceramic-to-metal bore-seal technology, and simulated-space environmental testing of electric-power system components Author

N73-18085# AEG-Telefunken, Hamburg (West Germany).
THE SUBSYSTEM POWER CONDITIONING FOR THE SYMPHONIE COMMUNICATIONS SATELLITE [DAS UNTERSYSTEM ENERGIEAUFBEREITUNG IM NACHRICHTENSATELLITEN SYMPHONIE]
1972 22 p In GERMAN
(Rept-72-90) Avail: NTIS HC $3.25

The essential points of the Symphonie satellite power conditioning subsystem are discussed. The total energy necessary for operation of the satellite, accounting for losses, is about 165 watt, with peaks for stabilization maneuvers of 215 watt. The task of the power conditioning equipment is to provide constant power from the solar generator, in other words a constant bus voltage of 27 volts. The voltage regulating system is described in detail, and the practical construction of separate equipment is considered. ESRO

N73-18086# Royal Aircraft Establishment, Farnborough (England).
GAS COOLERS FOR SATELLITE ATTITUDE AND ORBIT CONTROL SYSTEMS USING HYDRAZINE
A. G. Earl Oct. 1972 13 p
(RAE-TR-72161) Avail: NTIS HC $3.00

The gas cooling requirements are reviewed of the attitude and orbit control systems of satellites using hydrazine as a low thrust propellant. Various cooler arrangements to meet these requirements are considered and it is concluded that a design employing the heat capacity of alumina rods encased in a stainless steel cylinder is the most attractive scheme. Author (ESRO)

N73-18087# Electrical Research Association, Leatherhead (England).
DEVELOPMENT OF INTEGRAL COVERS FOR SILICON SOLAR CELLS Final Report
G. Brackley, K. Lawson, D. W. Satchell, G. N. Jackson, and R. G. Picard Paris ESRO Nov. 1972 56 p refs
(Contract ESTEC-810/69)
(ESRO-CR-68) Avail: NTIS HC $5.00

The development is described of an improved technique for the protection of silicon solar cells in space whereby conventional cover slides mounted individually with adhesives will be replaced by a glass film deposited as an integral part of the cell. A survey of previous work led to the choice of radio frequency sputtering as the deposition method. In order to meet the requirements of high deposition rate and uniform thickness, a new double-chamber sputtering apparatus was developed. Since silicon is deposited with high built-in stresses, borosilicate glasses were selected as the cover material. The main problems encountered and solved were: built-in stresses, browning during deposition and structural defects. Adherence and resistance to thermal shock were excellent, but resistance to ionizing radiation must be improved. Production costs are estimated. ESRO

N73-18088# Siemens A.G., Munich (West Germany).
DEVELOPMENT OF ANNEALABLE SOLAR CELLS Final Report
G. Schmalhofer Paris ESRO Nov. 1972 115 p
(Contract ESTEC-1131/70)
(ESRO-CR-94) Avail: NTIS HC $7.75

The processing techniques for fabricating lithium-doped solar cells is described. Behavior of the cells during 1 MeV electron irradiation and annealing rates after fluences from 1 x 10 to the 14th power to 1 x 10 to the 16th power e/sq cm are studied. Effects of variations in starting material and lithium diffusion parameters are shown. It appears that lithium solar cells can be fabricated which exhibit recovered efficiencies in excess of efficiencies associated with normal cells. ESRO

N73-18089# Defence Research Establishment Ottawa (Ontario). Electrical Power Sources Div.
CARBON-BASED OXYGEN ELECTRODES FOR METAL-AIR BATTERIES. 3: THE CARBON-MANGANESE DIOXIDE ELECTRODE
William A. Armstrong Mar. 1972 15 p refs
(AD-751693; DREO-TN-72-2) Avail: NTIS CSCL 10/3

A simple method has been developed for the impregnation of activated carbon with manganese dioxide. The operational characteristics of an air cathode made from this material are superior to those previously reported for the C-MnO2 electrode. A zinc-air bicell equipped with this cathode operated with an energy density of 89 Wh/lb and maintained a cell voltage greater than 1.0 V when discharged at current densities up to 100 mA/sq cm. The C-MnO2 air cathode appears to be well suited for use in a reserve primary throw-away zinc-air battery. Author (GRA)

N73-18090# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF THERMAL ECONOMY OF COMBINED POWER INSTALLATIONS EMPLOYING OPEN-CYCLE MHD GENERATORS
L. S. Popyrin, N. N. Pshenichnov, and A. M. Roshchin 27 Oct. 1972 28 p refs Transl. into ENGLISH from MHD Symp. (Warsaw), v. 5, 1968 p 2893-2916
(AD-753031; FTD-HT-23-593-72) Avail: NTIS CSCL 10/2

A mathematical model was used to analyze the thermodynamic efficiency of combined power plants incorporating MHD generators. The mathematical model devised by the authors consists of three parts. The first part is designed to describe processes determining the physical parameters of the working media used. The second part describes processes associated with the conversion and transfer of energy in different elements of the installation, including the MHD generator. The third part is a complex model of an actual power plant (including oxygen enrichment of the oxidant.) When the mathematical model was being designed, actual technical restrictions were taken into account, i.e., the extent to which the parameters could be varied, and some of the technological characteristics of the installation. Author (GRA)

N73-18091# Yardney Electric Corp., Pawcatuck, Conn.
NEW MECHANICALLY RECHARGEABLE ZINC/AIR BATTERY DESIGN Interim Technical Report, 1 Feb. - 1 May 1972
Roland F. Chireau and Ronald Gunther Ft. Monmouth, N. J. ECOM Aug. 1972 38 p
(Contract DAAB07-71-C-0333; DA Proj. 1T6-62705-A-053)
(AD-753361; Rept-1514-72; ECOM-0333-3; ITR-3) Avail: NTIS CSCL 10/3

The report describes the design and development of mechanically rechargable zinc/air batteries for field communication systems. The blower-cover assembly described earlier was proof tested on the BA-525 (20 Ah) battery at an intermittent high rate regime. The details of the design are presented and performance data are discussed. A heater system was incorporated in a BA-525 Zinc/Air battery (20 cells, 20 Ah) prototype in order to improve cold temperature performance. The battery was evaluated on a high rate pulse regime using the blower-cover assembly. GRA

N73-18092# Calvin Coll., Grand Rapids, Mich. Dept. of Chemistry.
BATTERY ZINC ELECTRODE KINETICS INVESTIGATION Final Report, 15 Dec. 1969 - 15 Dec. 1972
T. P. Dirkse 15 Dec. 1972 84 p refs
(AD-753096; AFAPL-TR-72-87) Avail: NTIS CSCL 07/4

Time-to passivation studies have been made on the zinc electrode in a range of KOH solutions. Attempts to interpret results in terms of rate at which charge transfer product dissolves encountered theoretical difficulties. Limiting diffusion currents

have been measured in 1 to 13.4 M KOH over a temperature range of -33 to 44C. The diffusion coefficients of the zincate ion have been measured polarographically. The exhange current densities of the zinc electrode in KOH solutions were measured over a temperature range of -33 to -55C in 1 to 14 molar KOH. Galvanostatic, double impulse, and potentiostatic methods were used. Double layer capacitance of the zinc electrode was also measured at room temperature in a variety of solutions. An NMR study of Zincate Solutions shows only evidence for Zn(OH)4(-2). Author (GRA)

N73-18093# Army Foreign Science and Technology Center, Charlottesville, Va.
AUTONOMOUS ENERGETICS: ENERGY SOURCES FOR THE EARTH, SEA AND SPACE
26 Jun. 1972 5 p Transl. into ENGLISH from Khim. Zhizn (USSR), no. 10, 1970 p 34-36
(AD-753828; FSTC-HT-23-1088-72) Avail: NTIS CSCL 10/2

In February 1970, a general meeting of the Academy of Sciences of the USSR was held, devoted to the role of science in technical progress. In speaking of principal trends of development in modern science, the president of the Academy of Sciences, academician M. V. Keldysh mentioned the importance of work in the field of autonomous energetics. A member of the Academy of Sciences of the USSR, N. S. Lidorenko, told about the work that is going on in the development of physical and chemical energy sources. Author (GRA)

N73-18891* Lockheed Missiles and Space Co., Sunnyvale, Calif.
A 928 sq m (10000 sq ft) SOLAR ARRAY
Dale E. Lindberg *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 287-302 (For availability see N73-18866 09-31)
CSCL 10A

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-18094*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 109, DECEMBER 1972
Dec. 1972 123 p refs
(NASA-SP-7011(109)) Avail: NTIS HC $3.00 CSCL 06E

This special bibliography lists 430 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1972. Author

N73-18095*# BioTechnology, Inc., Falls Church, Va.
SHORT TERM HEARING LOSS IN GENERAL AVIATION OPERATIONS, PHASE 1, PART 1
James F. Parker, Jr. Sep. 1972 29 p refs
(Contract NASw-2265)
(NASA-CR-130987) Avail: NTIS HC $3.50 CSCL 06S

The effects of light aircraft noise on six subjects during flight operations were investigated. The noise environment in the Piper Apache light aircraft was found to be capable of producing hearing threshold shifts. The following are the principal findings and conclusions: (1) Through most of the frequency range for which measurements were taken (500 to 6000 Hz), there was a regular progression showing increased loss of auditory acuity as a function of increased exposure time. (2) Extensive variability was found in the results among subjects, and in the measured loss at discrete frequencies for each subject. (3) The principal loss of hearing occurred at the low frequencies, around 500 Hz. Author

N73-18096*# Delaware State Coll., Dover. Dept. of Biology.
THE EXAMINATION OF URINE SAMPLES FOR PATHOGENIC MICROBES BY THE LUCIFERASE ASSAY FOR ATP. 1: THE EFFECT OF THE PRESENCE OF FUNGI, FUNGAL LIKE BACTERIA AND KIDNEY CELLS IN URINE SAMPLES
Technical Report, 15 Jan. - 15 Nov. 1972
Valerie N. Bush Jan. 1973 16 p refs
(Grant NGR-08-002-003)
(NASA-CR-130797) Avail: NTIS HC $3.00 CSCL 06M

A method for accurately determining urinary tract infections in man is introduced. The method is based on adenosine triphosphate (ATP) concentration in urine samples after removing nonbacterial ATP. Adenosine triphosphate concentration is measured from the bioluminescent reaction of luciferase when mixed with ATP. An examination was also made of the effectiveness of rupturing agents on monkey kidney cells Candia albicans, a Rhodotorula species, and a Streptomyces species in determining whether these cells could contribute ATP to the bacterial ATP value of a urine sample. E.H.W.

N73-18097*# Southwest Research Inst., San Antonio, Tex.
SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY UTILIZATION PROGRAM Monthly Report, 1 - 31 Jan. 1973
Jan. 1973 115 p
(Contract NASw-1867; SwRI Proj. 13-2538)
(NASA-CR-130984) Avail: NTIS HC $7.75 CSCL 06B

Applications of aerospace technology to biomedical science are described. Recent research and development of specific techniques, services, and equipment adopted by physicians to help combat disease and disability are reviewed. J.M.M.

N73-18098*# Scientific Translation Service, Santa Barbara, Calif.
PHYSICAL AND RADIOBIOLOGICAL INVESTIGATIONS ON ARTIFICIAL EARTH SATELLITES: ESTIMATING THE RADIATION HAZARD OF SPACE FLIGHTS
Yu. G. Grigoryev, ed. and Ye. Ye. Kovalev, ed. Washington NASA Jan. 1973 237 p refs Transl. into ENGLISH of the book "Fizicheskiye i Radiobiologicheskiye Issledovaniya na Iskusstvennykh Sputnikakh Zemli: Kotsenke Radiatsionnoy Opasnosti Kosmicheskikh Poletov" Moscow, Atom Press, 1971 p 1-198
(Contract NASw-2035)
(NASA-TT-F-724) Avail: NTIS HC $3.00 CSCL 06R

Experimental data obtained by artificial satellites are presented along with data from the literature reflecting the results of physical and medico-biological investigations of space radiation hazards to biological systems. For individual titles, see N73-18099 through N73-18103.

N73-18099* Scientific Translation Service, Santa Barbara, Calif.
THE RADIATION HAZARD DURING SPACE FLIGHTS **c29**
Ye. Ye. Kovalev, A. V. Kolomenskiy, L. N. Smirennyy, and V. M. Petrov *In its* Phys. and Radiobiol. Invest. on Artificial Earth Satellites Jan. 1973 p 1-23 refs (For availability see N73-18098 09-04)
CSCL 18F

Galactic cosmic radiation is described. Distinctive features of radiation effects in space flights are discussed and space radiation hazards are estimated. Measures to provide radiation safety during space flights are given. The need for safety standards is emphasized. Author

N73-18100* Scientific Translation Service, Santa Barbara, Calif.
DOSIMETRY OF SPACE RADIATIONS
V. V. Arkhangelskiy, V. V. Markelov, S. S. Skvortsov, L. N. Smirennyy, V. N. Turkin, and I. V. Chernykh *In its* Phys. and Radiobiol. Invest. on Artificial Earth Satellites Jan. 1973 p 24-56 refs (For availability see N73-18098 09-04)
CSCL 06R

Harmful effects of space radiation are discussed. Radiation dosimetry methods are given. Dosimetry monitoring is investigated. Methods for measuring space radiation by ionization, thermoluminescence, and nuclear photographic emulsions are described. Author

N73-18101* Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATION OF SHIELDING FROM COSMIC RADIATION **c29**
V. Ye. Dubkin, Ye. Ye. Kovalev, S. S. Skvortsov, L. N. Smirennyy, and A. I. Vikhrov *In its* Phys. and Radiobiol. Invest. on Artificial Earth Satellites Jan. 1973 p 57-84 refs (For availability

see N73-18098 09-04)
CSCL 18F

Shielding from cosmic radiation is investigated. Attenuation of high energy protons in shielding material is noted and accumulations of radiation doses due to nuclear interactions in the shielding are studied. Shielding of artificial earth satellites is described. Author

N73-18102* Scientific Translation Service, Santa Barbara, Calif.
THE BIOLOGICAL EFFECT OF COSMIC RADIATION AND THE STANDARDIZATION OF A PERMISSIBLE DOSE LEVEL (ON CONDUCTING RADIOBIOLOGICAL EXPERIMENTS IN OUTER SPACE)
In its Phys. and Radiobiol. Invest. on Artificial Earth Satellites Jan. 1973 p 85-129 refs (For availability see N73-18098 09-04)
CSCL 06R

Radiobiological effects of cosmic radiation are investigated by animal experimentation. Prolonged radiation effects on humans are evaluated clinically. Methods for standardizing permissible radiation levels for spacecraft crews are discussed. Author

N73-18103* Scientific Translation Service, Santa Barbara, Calif.
THE COMBINED EFFECT OF IONIZING RADIATION AND OTHER SPACE FLIGHT FACTORS (RESULTS OF FLIGHT EXPERIMENTS)
In its Phys. and Radiobiol. Invest. on Artificial Earth Satellites Jan. 1973 p 130-229 refs (For availability see N73-18098 09-04)
CSCL 06R

Problems and conditions of conducting radiobiological experiments in outer space are investigated. Effects of ionizing radiation and other prolonged space flight factors on animals are studied. Relationship of nonradiation space flight factors to radiation damage is evaluated. Author

N73-18104*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCEEDINGS OF THE 1971 MANNED SPACECRAFT CENTER ENDOCRINE PROGRAM CONFERENCE
Carolyn S. Leach Nov. 1972 167 p refs Conf. held at Houston, Tex., Dec. 1971
(NASA-TM-X-58093; MSC-07232) Avail: NTIS HC $10.50
CSCL 06P

The effects of space flight stress on human hormonal and endocrine functions are studied in simulated weightlessness environments as well as postflight in spacecrews. For individual titles, see N73-18105 through N73-18115.

N73-18105* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ENDOCRINE LABORATORY RESULTS APOLLO MISSIONS 14 AND 15
Carolyn S. Leach *In its* Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 21 p refs (For availability see N73-18104 09-04)
CSCL 06P

Endocrine/metabolic responses to space flight have been measured on the crewmen of Apollo missions 14 and 15. There were significant biochemical changes in the crewmen of both missions immediately postflight. However, the Apollo 15 mission results differed from Apollo 14 and preflight shown by a normal to increased urine volume with slight increases in antidiuretic hormone. Although Apollo 15 was the first mission in which the exchangeable potassium measurement was made (a decrease), results from other missions were indicative of similar conclusions. Author

N73-18106* Baylor Univ., Houston, Tex. Coll. of Medicine.
THE MEDICAL ASPECTS OF SPACE FLIGHT SEEN FROM THE VIEWPOINT OF NUCLEAR MEDICINE
Philip C. Johnson and Theda B. Driscoll (Tex. Med. Center, Houston) *In* NASA. Lyndon B. Johnson Space Center Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 8 p (For availability see N73-18104 09-04)
CSCL 06S

Radionuclide volume measurements performed on crews of selected Apollo missions indicate the following: (1) Invariably, there is a small drop in red-cell mass of the returning crewmembers; (2) plasma-volume decreases similar to those experienced during bedrest are found in crewmen of short Gemini missions. After longer missions, the plasma-volume decrease is no longer present; (3) extracellular- and total-body water changes prove that spaceflight weight loss includes actual tissue losses; and (4) the loss of total-body exchangeable potassium after the Apollo 15 mission is evidence of increased aldosterone secretion. Author

N73-18107* State Univ. of New York, Syracuse. Upstate Medical Center.
URINARY EXCRETION OF ANTIDIURETIC HORMONE IN MAN
Myron Miller *In* NASA. Lyndon B. Johnson Space Center Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 15 p refs (For availability see N73-18104 09-04)
CSCL 06P

It is shown that urinary excretion of ADH can be detected readily and quantitated accurately. The ADH excretion in normal subjects is inhibited following the administration of a water load and stimulated following water deprivation. It appears that measurement of ADH excretion in man provides a means of quantitating alterations in neurohypophyseal ADH secretion. By determining not only the basal excretion of ADH but also the response to such physiological influences as water loading and dehydration, it becomes possible to study the dynamics of ADH release. Thus, the ability to extract ADH efficiently from urine combined with a sensitive and specific technique for determination of ADH concentration allows the exploration of regulatory systems for ADH control in the normal state as well as the etiological role of altered ADH secretion in clinical disorders of water balance. Author

N73-18108* West Virginia Univ., Morgantown.
ESTIMATION OF VASOPRESSIN EXCRETION IN THE URINE AS A METHOD OF MONITORING VASOPRESSIN SECRETION DURING SPACE FLIGHT
Walter H. Moran *In* NASA. Lyndon B. Johnson Space Center Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 12 p refs (For availability see N73-18104 09-04)
CSCL 06P

It is demonstrated that, under the circumstances of space flight, the measurement of plasma ADH levels might be misleading and that only the urinary ADH levels provide reliable information. The results of a partially completed survey of ADH levels in urine samples from human subjects in which simultaneous plasma ADH levels were available are included. Author

N73-18109* Baylor Univ., Houston, Tex. Coll. of Medicine.
ADRENOCORTICOTROPHIC HORMONE LEVELS IN GROUND BASED STUDIES
Bonnalie O. Campbell *In* NASA. Lyndon B. Johnson Space Center Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 9 p refs (For availability see N73-18104 09-04)
CSCL 06P

Baseline values of immunoreactive ACTH were established in the normal healthy adult. Normal levels of ACTH secretion were determined for both the male and the female in circulating plasma and serum. The data obtained in these studies are particularly significant in that the sampling was carefully controlled; only healthy employed individuals of both sexes were tested in a routine work situation that would not be considered conducive to stress. It has been found that alterations in the classically described circadian rhythm of ACTH secretion can occur when activities (such as work/rest cycles) are imposed on the individual studied. These changes can be demonstrated even when there is no appreciable change noted in the rhythm of hydrocortisone secretion. Author

N73-18110* Miami Univ., Fla. School of Medicine.
STUDIES OF THE RENIN-ALDOSTERONE SYSTEM AND SODIUM HOMEOSTASIS DURING SIMULATED WEIGHTLESSNESS: APPLICATION OF THE WATER IMMERSION MODEL TO MAN

Murray Epstein *In* NASA. Lyndon B. Johnson Space Center Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 13 p refs (For availability see N73-18104 09-04)
CSCL 06P

The ability of water immersion to reproducibly suppress renin and aldosterone and to produce a significant natriuresis in man during weightlessness simulation is proven. It is concluded that the water immersion model constitutes a useful tool for elucidating the mechanism of natriuresis occurring during manned space flight and the specific countermeasures for use in its management. Author

N73-18111* Harvard Univ., Cambridge, Mass. School of Medicine.
DEVELOPMENT OF SENSITIVE AND DIRECT METHODS FOR MEASURING PLASMA ALDOSTERONE AND CATECHOLAMINE CONCENTRATIONS
Edgar Haber *In* NASA. Lyndon B. Johnson Space Center Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 12 p refs (For availability see N73-18104 09-04)
CSCL 06P

Radioimmunoassays for renin activity, angiotensin 1, and angiotensin 2 in the study of vasomotor regulation give new insight into the role of the renin system in maintaining postural homeostatsis. Similar laboratory procedures for specific assays of aldosterone and catecholamines achieve accurate determinations in small human blood samples. Author

N73-18112* Harvard Univ., Cambridge, Mass. School of Medicine.
PARATHYROID HORMONE, CALCITIONIN, AND VITAMIN D
John T. Potts *In* NASA. Lyndon B. Johnson Space Center Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 28 p refs (For availability see N73-18104 09-04)
CSCL 06O

Analyses of secretion of parathyroid hormone during tests of stimulation and suppression of hormone-secretory activity using infusions of EDTA and calcium, respectively, have established that, in contrast to previous views, secretion of the hormone is not autonomous in many patients that have adenomatous hyperparathyroidism, but is responsive to changes in blood-calcium concentration. These findings have led to a new understanding of the pathophysiology of hormone production in hyperparathyroidism. A related application of the diagnostic use of the radioimmunoassay is the preoperative localization of parathyroid tumors and the distinction between adenomas and chief-cell hyperplasia. Work involving catheterization and radioimmunoassay of blood samples obtained from the subclavin and innominate veins and the venae cavae, led to localization in a high percentage of patients. However, this procedure has been adopted recently to detect hormone concentration in the small veins directly draining the parathyroid glands. Author

N73-18113* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DISSOCIATION OF EFFECTS OF PROLONGED CONFINEMENT AND BEDREST IN NORMAL HUMAN SUBJECTS: HEART RATE AND BODY TEMPERATURE
Charles M. Winget, Joan Vernikos-Danellis, Carolyn S. Leach, and Paul C. Rambaut *In its* Proc of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 13 p refs (For availability see N73-18104 09-04)
CSCL 06S

The effect of restricted muscular activity during bed rest in weightlessness simulation on certain physiological rhythms is investigated in human subjects. Results indicate that the primary influence of bed rest on body temperature and heart rate periodicity is to reduce the amplitude and change their phase relationships. The normally entrained rhythms are altered after approximately 20 days in the hypokinetic environment and are expressed in changes of amplitude and phases. Bed rest induces low grade hypothermia and minor tachycardia. This is characteristic of acute stress, regardless of the cause of stress. Author

N73-18114* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DISSOCIATION OF EFFECTS OF PROLONGED CONFINEMENT AND BED REST IN NORMAL HUMAN SUBJECTS; CORTISOL, INSULIN, THYROXINE, AND TRIIODOTHYRONINE
Joan Vernikos-Danellis, D. M. Winget, Carolyn S. Leach, and Paul C. Rambaut *In its* Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 8 p refs (For availability see N73-18104 09-04)
CSCL 06S

Endocrine and metabolic information on the relative effects of confinement and prolonged bed rest in man was obtained by assaying blood samples for changes in cortisol, insulin, thyroxine, and triiodothyronine levels. Diurnal rhythms existed in all four hormone levels during prebed rest control period. Thyroid rhythms were most affected by bed rest and decreased markedly or showed considerable phase shifts: whereas the hydrocortisone rhythm was little affected. A marked decrease in the amplitude of the steroid rhythm developed by the end of the study. Author G.G.

N73-18115* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NUTRITION AND MUSCULOSKELETAL FUNCTION: SKYLAB EXPERIMENT SERIES NUMBER M070
Paul C. Raumbaut *In its* Proc. of the 1971 Manned Spacecraft Center Endocrine Program Conf. Nov. 1972 10 p refs (For availability see N73-18104 09-04)
CSCL 06P

The M070 experiments are expected to give medical investigators precise information on a variety of biochemical changes occurring during exposure to space flight. Sufficient control data are being generated by baseline studies to differentiate those effects that are caused by weightless flight and those that are caused by other abnormal conditions that normally accompany spaceflight. Author

N73-18116*# Techtran Corp., Glen Burnie, Md.
MEDICINE AND SPACE
N. A. Agadzhanyan Washington NASA Feb. 1973 40 p refs Transl. into ENGLISH from Novye v Zhizne, Nauke Tekhn., Ser. Med. (Moscow), no. 4, 1971 p 1-32
(Contract NASw-2037)
(NASA-TT-F-735; F-735) Avail: NTIS HC $3.00 CSCL 06S

Medical data covering the effects of abnormal conditions on man are presented. Data cover high accelerations, weightlessness, and prolonged stay in space ship environments. E.H.W.

N73-18117# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
STUDIES ON THE INFLUENCE OF PERVITIN ON THE INCIDENCE OF GAS BUBBLES IN BLOOD AFTER DECOMPRESSION
V. Rheinwald 1972 49 p refs In GERMAN; ENGLISH summary (DLR-FB-72-66) Avail: NTIS HC $4.50; DFVLR Porz-Wahn: 14,20 DM

The influence of the pharmacon Pervitin on the incidence of gas bubbles in blood during quick decompression was proved in experiments with albino rats. The starting point of this study was the fact, that the blood-circulation determines the elimination of gas during decompression. Opposed results show the theoretical supposition that Pervitin improves elimination of N2 during decompression because of its effect on circulation, is not well founded. Preventive treatment of rats with Pervitin medication led to no significant reduction of mortality. Author

N73-18118# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
THE EFFECTS OF HYPOXIA AND ACCELERATION ON SOME ENZYME ACTIVITIES IN ERYTHOCYTES AND PLASMA
Ingo Carl 1972 44 p refs In GERMAN; ENGLISH summary (DLR-FB-72-71) Avail: NTIS HC $4.25; DFVLR Porz: 13,80 DM

Eleven male subjects were exposed to hypoxia corresponding

to an altitude of 6900 meters and to acceleration of 2,5 + Gz. Prior to stress and at certain intervals during and after it the number of erythrocytes, hematocrit, and plasma protein concentration were determined. Erythrocytes, hematocrit, and plasma protein increased under both conditions. Under hypoxia the activities of MDH and GOT increased significantly, under acceleration only the activity of GOT. Except of the G-6-PDH activity which showed a considerable rise under hypoxia no significant changes could be observed in enzyme activities in erythrocytes under both stressors. Since there is no congruent reaction in the enzyme activities in erythrocytes and plasma, erythrocytes cannot be considered to be main enzyme source for the plasma level in the ubiquitary cell enzymes. The different responses of the measured blood parameters to both stressors indicate a specific reaction depending upon the kind of stress. Author

N73-18119# Leicester Univ. (England). Dept. of Psychology.
SIMULATOR SICKNESS IN PASSIVE OBSERVERS
J. T. Reason and E. Diaz London Flying Personnel Res. Comm. Jul. 1971 19 p refs Sponsored by Flying Personnel Res. Comm.
(FPRC/1310) Avail: NTIS HC $3.00

Fifteen women and sixteen men were given a 10-minute ride in a fixed-base car simulator with a moving visual display (Sim-L-Car). These exposures were standardized, and included a considerable amount of implied (but not actual) vestibular simulation. Approximately one half of the subjects wore blinkers which restricted their field of view to the dynamic visual display. The principal findings were: (1) Some measurable decline in well-being was reported by 28 of the 31 subjects: (2) Women were significantly more susceptible than men: (3) Both previous passenger and car driving experience correlated positively with the degree of disturbance produced by the simulator, but driving experience appeared to exert the greatest influence upon susceptibility: (4) Exclusion of the static features of the field of view appeared to have no effect upon susceptibility. These results were interpreted in the light of the sensory rearrangement theory of motion sickness. Author

N73-18120# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
A BRIEF GUIDE TO THE UNITS AND THE INTERPRETATION OF BLOOD ALCOHOL MEASUREMENTS
W. F. Lewis Jun. 1972 9 p refs
(DCIEM-TM-848) Avail: NTIS HC $3.00

A guide is presented for investigators to correlate blood ethanol levels reported by laboratories with possible causes of aviation accidents. Methods of ethanol analysis, different concentration units, a tabulation of expected effects from given levels, and a number of precautionally interpretive considerations are presented. Author

N73-18121*# Scripta Technica, Inc., Washington, D.C.
HYPERTONIA AND ATHEROSCLEROSIS UNDER HIGH MOUNTAIN CONDITIONS
M. A. Aliyev and R. I. Kulakova NASA Feb. 1973 105 p refs Transl. into ENGLISH of the publ. "Gipertonia i ateroskleroz v usloviyakh vysokogorya" Frunze, USSR, Ilim, 1971 115 p
(Contract NASw-2036)
(NASA-TT-F-745) Avail: NTIS HC $3.00 CSCL 06S

Problems in the development and course of experimental atherosclerosis against a background of renovascular hypertonia and their interaction in long term acclimatization with consideration of the meteorological and heliogeophysical factors operating in the high mountains are illuminated. Incidental data on the variations of cholesterol, lecithin, and the lecithin-cholesterol coefficient under the conditions of low and high mountains are presented as they depend on season. Author

N73-18122*# Pittsburgh Univ., Pa. Philosophy of Science Center.
ON THE FUNDAMENTAL IMPORTANCE OF THE SOCIAL PSYCHOLOGY OF RESEARCH AS A BASIC PARADIGM FOR THE PHILOSOPHY OF SCIENCE: A PHILOSOPHICAL CASE STUDY OF THE PSYCHOLOGY OF THE APOLLO MOON SCIENTISTS
Ian I. Mitroff [1972] 44 p refs
(Grant NGL-39-011-080)
(NASA-CR-130832) Avail: NTIS HC $4.25 CSCL 05I

A combined philosophical and social psychological study of over 40 of the Apollo moon Scientists reveals that the Orthodox or Received View of Scientific Theories is found wanting in several respects: (1) observations are not theory-free; (2) scientific observations are not directly observable; and (3) observations are no less problematic than theories. The study also raises some severe criticisms of distinction between the context of discovery and the context of justification. Not only does this distinction fail to describe the actual practice of science but even more important it has the dangerous effect of excluding some of the strongest lines of evidence which could most effectively challenge the distinction. The distinction is harmful of efforts to found interdisciplinary theories and philosophies of science. Author

N73-18123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETARY QUARANTINE ANNUAL REVIEW, SPACE TECHNOLOGY AND RESEARCH, JULY 1971 - JULY 1972
Feb. 1973 205 p refs
(Contract NAS7-100)
(NASA-CR-130861; JPL-900-597) Avail: NTIS HC $12.25 CSCL 06M

The effects of planetary quarantine constraints are assessed for advanced missions and unmanned planetary sample return missions. Considered are natural space environment factors, post launch recontamination effects, spacecraft microbial burden estimation and prediction, and spacecraft cleaning and decontamination techniques. G.G.

N73-18124*# Columbia Univ., New York. Noise Research Unit.
A NEW FIELD-LABORATORY METHODOLOGY FOR ASSESSING HUMAN RESPONSE TO NOISE
Paul N. Borsky Washington NASA Mar. 1973 32 p refs
(Grant NGL-33-008-118)
(NASA-CR-2221) Avail: NTIS HC $3.00 CSCL 06S

Gross measures of community annoyance with intrusive noises have been made in a number of real environment surveys which indicate that aircraft noise may have to be reduced 30-40 EPNdb before it will generally be considered acceptable. Interview studies, however, cannot provide the precise information which is needed by noise abatement engineers of the variable human response to different types and degrees of noise exposure. A new methodological field-survey approach has been developed to provide such information. The integrated attitudes and experiences of a random sample of subjects in the real environment are obtained by a prior field survey. Then these subjects record their more precise responses to controlled noise exposures in a new realistic laboratory. The laboratory is a sound chamber furnished as a typical living room (18 ft x 14 ft) and subjects watch a color TV program while they judge simulated aircraft flyovers that occur at controlled levels and intervals. Methodological experiments indicate that subjects in the laboratory have the sensation that the airplanes are actually moving overhead across the ceiling of the chamber. It was also determined that annoyance judgments in the laboratory stabilize after three flyovers are heard prior to a judgment of annoyance. Author

N73-18125# Joint Publications Research Service, Arlington, Va.
FOURTH ALL-UNION CONFERENCE ON SPACE BIOLOGY AND MEDICINE
N. Gurovskiy and M. Kozar 28 Feb. 1973 8 p Transl. into ENGLISH from Med. Gaz. (Moscow), 19 Jan. 1973
(JPRS-58345) Avail: NTIS HC $3.00 CSCL 06C

A review of the materials presented at the Fourth All-Union conference on Space Biology and Medicine held in Kaluga is reported. A total of 254 reports were presented at three plenary and 24 section meetings. Author

N73-18126# Joint Publications Research Service, Arlington, Va.
RHYTHM OF SLEEP AND WAKEFULNESS IN CREWS OF THE SPACESHIPS SOYUZ 3-9 BEFORE, DURING AND AFTER EXPOSURE TO SPACEFLIGHT
A. N. Litsov 22 Mar. 1973 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 6, 1972

p 836-845
(JPRS-58173) Avail: NTIS HC $3.00

Data are presented on the work and rest regimes of crew members of Soyuz 3-9 spacecraft in the course of preparation for and implementation of space flight. Author

N73-18127*# Oak Ridge National Lab., Tenn. Neutron Physics Div.

RADIATION TRANSPORT CODES FOR POTENTIAL APPLICATIONS RELATED TO RADIOBIOLOGY AND RADIOTHERAPY USING PROTONS, NEUTRONS, AND NEGATIVELY CHARGED PIONS

T. W. Armstrong Aug. 1972 27 p refs Submitted for publication Sponsored in part by AEC
(NASA Order H-38280A)
(NASA-CR-130965; ORNL-TM-3816) Avail: NTIS HC $3.50 CSCL 06R

Several Monte Carlo radiation transport computer codes are used to predict quantities of interest in the fields of radiotherapy and radiobiology. The calculational methods are described and comparisions of calculated and experimental results are presented for dose distributions produced by protons, neutrons, and negatively charged pions. Comparisons of calculated and experimental cell survival probabilities are also presented.
Author

N73-18128*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

A STUDY OF LIVER MICROSOMAL CYTOCHROMES FOLLOWING CHRONIC EXPOSURE TO DICHLOROMETHANE

F. J. Bullock (Little (Arthur D.), Inc., Cambridge, Mass.), M. Callahan (Little (Arthur D.), Inc., Cambridge, Mass.), and E. S. Harris Dec. 1971 11 p refs Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. 2 Sep. 1971; Sponsored by SysteMed Corp. Prepared in cooperation with AMRL
(AF Proj. 6302)
(NASA-TM-X-69101; AD-751433; AMRL-TR-71-120-Paper-11) Avail: NTIS HC $3.00 CSCL 06T

It was noted that CCl3CH3 has been reported to result in an increase of cytochrome P-450 as well as NADPH-cytochrome c reductase in rat liver. The chlorocarbon was administered by inhalation at 2500-3000 ppm for 24 hours. GRA

N73-18129*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

CONTINUOUS ANIMAL EXPOSURE TO METHYLENE-CHLORIDE

Charles C. Haun (SysteMed Corp., Dayton, Ohio), Elliott S. Harris, and Kenneth I. Darmer, Jr. (SysteMed Corp., Dayton, Ohio) Dec. 1971 13 p refs Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; Sponsored by SysteMed Corp. Prepared in cooperation with AMRL
(AF Proj. 6302)
(NASA-TM-X-69099; AD-751432; AMRL-TR-71-120-Paper-10) Avail: NTIS HC $3.00 CSCL 06T

Dichloromethane, also known as methylene chloride, is used extensively as a solvent in many of the space cabin construction materials. The provisional space cabin limit has been set at 25 ppm for 90-day flights, and 5 ppm for 1000-day flights. To properly assess the inhalation hazard to astronauts, 2 high levels, 1000 and 5000 ppm, were intentionally selected and 4 animal species were exposed continuously to these concentrations for periods of not more than 14 weeks. The following observed changes were most significant: (1) Severe weight losses were observed in all species, most profound in dogs. (2) Dogs and monkeys continued to lose weight throughout the exposure or until death, and rats showed dose related subnormal growth rates when compared with controls. (3) At 5000 ppm dichloromethane, there were considerable deaths during the first 3 weeks; 50% in dogs, 25% in monkeys and 35% in mice. No rats died. At 1000 ppm exposure level, significant deaths occurred only in dogs when 6 died during the 6th and 7th weeks and the remaining 2 dogs became moribund. (4) Monkeys exposed to dichloromethane at 1000 ppm level for 14 weeks showed clinical signs of liver injury. (5) Rats showed no response at either exposure level other than growth depression. (6) Dogs that died exhibited gross lesions associated with hepatic failure. GRA

N73-18130*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

CONTINUOUS EXPOSURE OF ANIMALS TO METHYLISOBUTYLKETONE

Edmond H. Vernot (SysteMed Corp., Dayton, Ohio), James D. MacEwen (SysteMed Corp., Dayton, Ohio), and Elliott S. Harris Dec. 1971 12 p refs Presented at 2d Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 31 Aug. - 2 Sep. 1971; Sponsored by SysteMed Corp. Prepared in cooperation with AMRL
(AF Proj. 6302)
(NASA-TM-X-69100; AD-751443; AMRL-TR-71-120-Paper-22) Avail: NTIS HC $3.00 CSCL 06T

Continuous exposure of dogs, monkeys, mice, and rats to MIBK for two weeks and all animals except mice for 90 days resulted in measurable adverse effects only in the case of rats. Rat kidney weights and kidney to body weight ratios were significantly elevated after exposure to 410 mg/cu m for two weeks, and kidney and liver organ weights and organ to body weight ratios were elevated after exposure to 820 mg/cu m for two weeks and to 410 mg/cu m for 90 days. GRA

N73-18131# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

ANALYSIS OF SOLUBLE BERYLLIUM BY GAS CHROMATOGRAPHY Final Report, Jul. 1968 - Nov. 1970

Michael L. Taylor and Eugene L. Arnold Aug. 1972 37 p refs
(Contracts F33615-71-C-1008; F33615-69-C-1062; AF Proj. 6302)
(AD-753112; AMRL-TR-71-117) Avail: NTIS CSCL 06/1

A new microanalytical method for the detection and quantitation of beryllium in aqueous samples and biological specimens has been developed. The method, based upon quantitation of chelated beryllium by gas chromatography, was employed to detect beryllium in both in vitro samples and tissues of rats given beryllium by injection. Beryllium was administered in the form of aqueous solutions of beryllium sulfate, and as little as 10 nanograms beryllium per gram of whole blood were detected and quantitated. In vivo studies which compared gas chromatographic analyses with radiometric analyses confirmed the validity of the new microanalytical technique. Preliminary studies were conducted to determine the ability of fluorinated chelating agents to remove beryllium oxide from the lungs of rats. Author (GRA)

N73-18132# Florida Univ., Gainesville. Communications Sciences Lab.

THE CONTRIBUTION OF THE EXTERNAL AUDITORY MEATUS TO HUMAN AUDITORY SENSITIVITY

Harry Hollien, Howard B. Rothman, and Stephen Feinstein 1 Jul. 1972 16 p refs
(Contract N00014-68-A-0173-0008; NR Proj. 196-114)
(AD-751664; CSL/ONR-40) Avail: NTIS CSCL 06/16

Support for, and a refinement of, the hypothesis that divers hear primarily by bone conduction was provided by Hollien and Brandt. To further test this hypothesis, the thresholds of seven submerged listeners were obtained (at frequencies of 0.25, 0.50, 1.0, 4.0 and 8.0 kHz) under three different conditions: (1) while they wore a full 3/16 in. wet suit with no hood, (2) while wearing a full 3/16 in. wet suit with a 3/16 in. hood and (3) while wearing a full 3/16 in. wet suit and hood with 1/4 in. rubber tubes passing through the hood to the external auditory meatuses. There were no significant differences between the conditions involving the use of a hood but thresholds were significantly lower in the middle and high frequencies for the no-hood condition. These findings provide further support for the hypothesis that underwater sound energy is transduced by bone conduction rather than by the normal middle ear linkage.
Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-18133*# City Coll. of the City of New York.
NONLINEAR AND DIGITAL MAN-MACHINE CONTROL SYSTEMS MODELING Final Report
Ralph Mekel Nov. 1972 112 p refs
(Grant NGR-33-013-053)
(NASA-CR-112258; Rept-72-447-01) Avail: NTIS HC $7.75 CSCL 05H

An adaptive modeling technique is reported by which controllers can be synthesized to provide corrective dynamics to a human operator's mathematical model in closed loop control systems. The technique utilizes a class of Liapunov functions formulated for this purpose. Liapunov's stability criterion and a model-reference system configuration. The Liapunov function is formulated to possess variable characteristics to take into consideration the identification dynamics. The time derivative of the Liapunov function generates the identification and control laws for the mathematical model system. These laws permit the realization of a controller which updates the human operator's mathematical model parameters so that model and human operator produce the same response when subjected to the same stimulus. A digital computer program which is easily implemented and modified concurrent with experimentation permits the modeling process to interact with the experimentation process. Author

N73-18134*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
COST ANALYSIS OF WATER RECOVERY SYSTEMS
M. M. Yakut 15 Dec. 1912 79 p
(Contract NAS8-28377)
(NASA-CR-124098; MDC-G3994) Avail: NTIS HC $6.00 CSCL 06K

Cost and performance data from Gemini, Skylab, and other aerospace and biotechnology programs were analyzed to identify major cost elements required to establish cost estimating relationships for advanced life support subsystems for long range planning in support of earth orbital programs. Cost analysis are presented for five leading water reclamation systems; (1) RITE waste management-water system;(2) reverse osmosis system;(3) multifiltration system;(4) vapor compression system; and(5) closed air evaporation system with electrolytic pretreatment. Author

N73-18135*# Howard Univ., Washington, D.C.
SUMMER BIOMEDICAL ENGINEERING INSTITUTE 1972 Final Report
Eugene M. DeLoatch 31 Jan. 1973 269 p refs
(Contract NASw-2386)
(NASA-CR-130809) Avail: NTIS HC $15.50 CSCL 06B

The five problems studied for biomedical applications of NASA technology are reported. The studies reported are: design modification of electrophoretic equipment, operating room environment control, hematological viscometry, handling system for iridium, and indirect blood pressure measuring device. F.O.S.

N73-18136# Joint Publications Research Service, Arlington, Va.
INTERACTION OF MAN-MACHINE SYSTEMS
Ye. V. Khrunov and A. G. Bryzhatyy 22 Feb. 1973 23 p refs Transl. into ENGLISH from Vopr. Psikhologii (Moscow), no. 6, 1972 p 80-85, 94-102
(JPRS-58290) Avail: NTIS HC $3.25

Articles are presented on the interaction of man and electronic computer in operational planning, and on psychological engineering and psychophysiological aspects of the activity of a cosmonaut-operator during docking and ship-to-ship transfer. For individual titles, see N73-18137 through N73-18138.

N73-18137 Joint Publications Research Service, Arlington, Va.
SOME PSYCHOLOGICAL ENGINEERING AND PSYCHOPHYSIOLOGICAL ASPECTS OF THE ACTIVITY OF A COSMONAUT-OPERATOR DURING DOCKING AND SHIP-TO-SHIP TRANSFER
Ye. V. Khrunov *In its* Interaction of Man-Machine Systems 22 Feb. 1973 p 1-8 (For availability see N73-18136 09-05)

The assignment of a significant role to the cosmonaut in spacecraft control is discussed for the approach and docking in orbit, during deceleration and descent, orientation and stabilization, and ship systems. Engineering-technical, psychological, and psychophysiological peculiarities in the activity of a cosmonaut are also discussed. F.O.S.

N73-18138 Joint Publications Research Service, Arlington, Va.
INTERACTION BETWEEN MAN AND AN ELECTRONIC COMPUTER IN OPERATIONAL PLANNING
A. G. Bryzhatyy, V. A. Terekhov, and O. K. Tikhnmirov *In its* Interaction of Man-Machine Systems 22 Feb. 1973 p 9-20 refs (For availability see N73-18136 09-05)

A psychological study is presented of man's activity in computerized production control. The human factors, and automated operational planning are discussed. F.O.S.

N73-18139*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CIRCUIT FOR DETECTING INITIAL SYSTOLE AND DICROTIC NOTCH Patent Application
Vernon D. Gebben and John A. Webb, Jr., inventors (to NASA) Filed 30 Jan. 1973 14 p
(NASA-Case-LEW-11581-1; US-Patent-Appl-SN-327921) Avail: NTIS HC $3.00 CSCL 06B

Circuitry for processing an arterial pressure waveform to produce a pulse corresponding to the initial systole and a pulse corresponding to the dicrotic notch is reported. In the initial systole detection channel after the arterial pressure waveform is filtered and caused to lag; it is then compared to the original waveform to produce square pulses which exist when the magnitude of the original pressure waveform is greater than the lagging waveform. These square pulses are fed through a filter to a comparator and then to an initial systole signal means. The arterial pressure waveform is also fed through a dicrotic notch detection channel in which the waveform is differentiated, and then filtered to reduce low frequency components thereby resulting in a signal which is related to a second derivative of the arterial pressure waveforms with respect to time. NASA

N73-18140# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
CHANGES OF THE CIRCADIAN RHYTHM OF THE BODY TEMPERATURE AFTER TRANSMERIDIAN FLIGHTS Ph.D. Thesis - Bonn. Univ. [DIE VERAENDERUNGEN DER TAGESPERIODISCHEN SCHWANKUNGEN DER KOERPERTEMPERATUR NACH TRANSMERIDIANEN FLUEGEN]
Joerg Mertens 1973 77 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-01) Avail: NTIS HC $6.00; DFVLR, Porz-Wahn: 21,40 DM

The oral body temperature of 12 pilots was studied at 2-hour-intervals during periods of 24 hours. Two 24-hour preflight periods revealed the basic normal rhythm of the body temperature. Effects of an 8-hour time shift were evaluated by determining the body temperature after flights from Germany to the U.S.A. and vice versa on day 1, 3, 5, and 8 after arrival. A desynchronization with the local time was observed after flights in both directions; however, the changes were more pronounced after the West-East flight. The resynchronization time amounted to 5 days after westward travel and at least 8 days after traveling in the opposite direction. Considerable individual differences were found in the duration and the extent of time shift effects. Author (ESRO)

N73-18141# Defense Documentation Center, Alexandria, Va.
MAN MACHINE INTERACTION Report Bibliography, Dec. 1953 - Mar. 1972
Nov. 1972 241 p refs
(AD-752800; DDC-TAS-72-71) Avail: NTIS CSCL 05/8

The annotated references include reports which study the human factors involved in solving and learning man-machine interactions, as well as the effective use of men in system design.

The indexes included are Corporate Author-Monitoring Agency, and Subject. Author (GRA)

N73-18142# Aerospace Corp., El Segundo, Calif. Lab. Operations.
IR LASER RADIATION EYE PROTECTOR Research Report, Jan. - Jun. 1971
Donald J. Specer and Henry A. Bixler 29 Sep. 1972 11 p ref
(Contract F40701-72-C-0073)
(AD-753080; TR-0073(3240-10)-4; SAMSO-TR-72-277) Avail: NTIS CSCL 06/17

Eye protection equipment has been developed that makes possible safe, unobstructed viewing in environments of potential eye damage caused by IR laser radiation. The viewing window consists of a 3-mm water sheet contained within lucite panes. The water absorbs virtually all the radiation at all wavelengths in the IR = 1.9 micrometers. A 3-micrometers laser beam from a continuous HF laser at a power level of 15 W and a heat flux of 400 W/sq cm for 20 sec produced a depression in the beamward lucite window pane, but did not penetrate to the water. Author (GRA)

N73-18143# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOVIET CYBERNETICS REVIEW (SELECTED ARTICLES)
I. N. Krasavin, K. S. Labets, A. A. Pustovoitenko, Yu. P. Goryunov, V. I. Bogomolov, and G. Boyko 31 Aug. 1972 22 p Transl. into ENGLISH from Soviet Cybernetics Rev. (USSR), v. 4, no. 7, 1970
(AD-751145; FTD-HC-23-0942-72) Avail: NTIS CSCL 05/9

Contents: Computer application in group training; Some methods of applying analog computers in the training process; Branched program for accelerated teaching of algorithmic languages. GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-18144*# Ohio State Univ. Research Foundation, Columbus.
PREPARATION OF PIGMENTS FOR SPACE-STABLE THERMAL CONTROL COATINGS Final Report, 1 Jun. 1968 - 31 Mar. 1972
W. B. Campbell and R. G. Smith May 1972 188 p refs
(Contract NAS8-21317)
(NASA-CR-124067) Avail: NTIS HC $11.50 CSCL 07A

The identification and control of vapor phase reaction kinetics to produce pigments by homogeneous nucleation were achieved. A vapor phase apparatus was designed, fabricated, and calibrated through 1800 C. Vapor phase reactions were analyzed, calculations made, and powders of alumina, rutile, zinc orthotitanate (in a mixed phase), calcium tungstate, and lanthana were produced by homogeneous nucleation. Electron microscopy shows uniform particle morphology and size, and supports anticipated advantages of vapor-phase homogeneous nucleation; namely, purity, freedom from defects, and uniform particle sizing without grinding. Author

N73-18145*# National Aeronautics and Space Administration, Washington, D.C.
STUDIES OF THE ALKALINE POLYMERIZATION OF HYDROCYANIC ACID AND ITS INHIBITION. PART 1: SPEED OF ALKALINE POLYMERIZATION OF HYDROCYANIC ACID
Masahiro Kurabayashi, Koshin Yanagiya, and Takuro Kamakura Mar. 1973 25 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 70, no. 3, 1967 p 352-357
(NASA-TT-F-14651) Avail: NTIS HC $3.25 CSCL 07D

Although it is known that hydrocyanic acid forms a blackish brown polymer known as azurmic acid under the action of an alkali, much is unknown of the polymerization reaction. Investigators working with liquid hydrocyanic acid discovered that the indication of the glass electrode pH meter was proportional to the logarithm of the alkali concentration, that there was progression of polymerization with pH exceeding 3, also that the pH value was maintained relatively constant during polymerization for pH 7-9. It was also found as a result of measuring the state of progress of polymerization at 10-25 C by colorimetry that the progression of the reaction was stationary, that the polymerization speed was proportional to the alkali concentration, that it was a special basic contact reaction, that the apparent activation energy was of the order of 9.2 kcal, and that the reaction could be attributed to an anion polymerization of the cyan-ion. Also with respect to hydrous hydrocyanic acid, it was discovered that water content up to 10 percent would depress the alkalinity and tend to restrict polymerization. Author

N73-18146*# National Aeronautics and Space Administration, Washington, D.C.
STUDIES OF THE ALKALINE POLYMERIZATION OF HYDROCYANIC ACID AND ITS INHIBITION. PART 2: PRODUCTS OF ALKALINE POLYMERIZATION OF HYDROCYANIC ACID
Masahiro Kurabayashi, Koshin Yanagiya, Masahiko Yasumoto, and Takuro Kamakura Mar. 1973 34 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 70, no. 7, 1967 p 1106-1111
(NASA-TT-F-14645) Avail: NTIS HC $3.75 CSCL 07D

The structure of polymers formed by the alkaline polymerization of hydrocyanic acid is generally undetermined, with the exception of the tetramer. Polymerization was conducted of anhydrous liquid hydrocyanic acid at near room temperature with the addition of a small amount of tetraethylamine or other alkali, and analysis by liquid chromatography for the lower polymers yielded, in addition to the tetramer, some products with an average degree of polymerization ranging from 5 to 10. Absorption spectra showed that these products had two kinds of conjugate structure at the ends, and it was assumed that the basic structure was similar to that of the tetramer polyaminocyanmethylene. Thermal decomposition and hydrolysis of a blackish-brown higher order polymer identified as azurmic acid, showed that the latter was an unstable substance with an order of polymerization of around 40, similar in structure to the lower order polymers, and that heating at over 100 C generated ammonia and hydrocyanic acid of which there was secondary condensation and the formation of stereopolymers. Author

N73-18147*# National Aeronautics and Space Administration, Washington, D.C.
STUDIES OF THE ALKALINE POLYMERIZATION OF HYDROCYANIC ACID AND ITS INHIBITION. PART 3: UNSTABILIZATION OF LIQUID HYDROCYANIC ACID AND STABILIZING AGENTS
Masahiro Kurabayashi and Koshin Yangagiya Mar. 1973 35 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Japan), v. 71, no. 7, 1968 p 984-989
(NASA-TT-F-14652) Avail: NTIS HC $3.75 CSCL 07D

With respect to the problem of instability of liquid hydrocyanic acid during storage, and the breakage of containers due to polymerization and the rapid progress of polymerization, clarification of the causes, inhibition of polymerization, and prediction of danger, investigations proceeded by sealing hydrocyanic acid with stabilizing agents and other related matter in small glass ampoules, maintaining them at 60 C and then observing any changes in the contents. The results showed that first among unstabilizing reactions was hydrolysis due to moisture contained in the ampoules, followed by the reaction forming the blackish-brown polymer initially at the container walls in contact with the gaseous phase, and the secondary de-ammoniation condensation of the polymers releasing ammonia gas. It was found that acids with pKa less than 3 were generally effective as stabilizing agents, particularly sulfuric acid and acids with reducing properties, and also oxy- acids which were very effective. It was found that the progress of the de-ammoniation condensation and the accumulation of polymerization heat due to the insulating effect of the polymers were directly responsible for container breakage. Based on these results, safety measures for the storage of liquid hydrocyanic acid were studied. Author

N73-18148# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

ROTATIONAL TEMPERATURE MEASUREMENT IN NITROGEN USING UNRESOLVED ROTATIONAL SPECTRA
D. Vennemann 1972 26 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-15; AVA-FB-7204) Avail: NTIS HC $3.50; DFVLR Porz-Wahn: 9 DM

A technique is reported, which differs from that normally employed in that unresolved rather than resolved rotational spectra are used for the temperature determination. Measurements with different densities indicate no density dependance of the deduced temperatures. Using the Hickmann exitation model the calculated temperatures are somewhat higher than the actual temperatures. Author

N73-18149# Defence Standards Labs., Maribyrnong (Australia).
SYNTHESES OF NITROSTYRENES
R. J. Mathews Jun. 1972 9 p refs
(TN-257) Avail: NTIS HC $3.00

Simple convenient syntheses are reported of 2-, 3-, and 4-nitrostyrene compounds of potential interest as reporter groups for energy transfer studies in polystyrene. Author

N73-18150# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aérothermique.
CONGELATION OF DISPERSE MEDIUM [CONGELATION DES MILIEUX DISPERSES]
J. Aguirre-Puente, Melle M. Vignes, and P. Viaud Jul. 1972 38 p refs In FRENCH
(CNRS/LA-Publ-440; Rept-72-3) Avail: NTIS HC $4.00

The effects of freezing on the structure of solid and porous soils and biological tissues are discussed. Data cover simple thermodynamic concepts, potential mass and heat transfer in the interface vicinity, permeability characteristics of non-frozen media, and proper humidity conditions. Transl. by E.H.W.

N73-18151*# Texas Technological Univ., Lubbock. Dept. of Chemical Engineering.
THE CATALYTIC REMOVAL OF AMMONIA AND NITROGEN OXIDES FROM SPACECABIN ATMOSPHERES
A. J. Gully, R. R. Graham, J. E. Halligan, and P. C. Bentsen Washington NASA Feb. 1973 163 p refs
(Contract NAS1-9506)
(NASA-CR-2132) Avail: NTIS HC $3.00 CSCL 07D

Investigations were made on methods for the removal of ammonia and to a lesser extent nitrogen oxides in low concentrations from air. The catalytic oxidation of ammonia was studied over a temperature range of 250 F to 600 F and a concentration range 20 ppm to 500 ppm. Of the catalysts studied, 0.5 percent ruthenium supported on alumina was found to be superior. This material is active at temperatures as low as 250 F and was found to produce much less nitrous oxide than the other two active catalysts, platinum on alumina and Hopcalite. A quantitative design model was developed which will permit the performance of an oxidizer to be calculated. The ruthenium was found to be relatively insensitive to low concentrations of water and to oxygen concentration between 21 percent and 100 percent. Hydrogen sulfide was found to be a poison when injected in relatively large quantities. The adsorption of ammonia by copper sulfate treated silica gel was investigated at temperatures of 72 F and 100 F. A quantitative model was developed for predicting adsorption bed behavior. Author

N73-18152*# Pittsburgh Univ., Pa. Space Research Coordination Center.
KINETICS OF THE REACTION OH (v EQUALS 0) PLUS O3 YIELDS HO2 PLUS O2
James G. Anderson and Frederick Kaufman Feb. 1973 16 p refs
(Grant NGR-39-011-002; Contract DA-ARO(D)-31-124-440; ARPA Order 826)
(NASA-CR-130858; SRCC-183) Avail: NTIS HC $3.00 CSCL 07D

The rate constant (kl) of the reaction OH(v=o) + O3 yields HO2 + O2 measured over the temperature range 220 to 450 K at total pressures between 2 and 5 torr using ultraviolet fluorescent scattering for the detection of OH radicals. An Arrhenius expression was obtained, and the rate constant for the reaction HO2 + O3 yields OH + 2O2 was inferred to be less than 0.1 kl over the entire temperature interval. Author

N73-18153# National Bureau of Standards, Washington, D.C.
[STUDIES OF IONIC PROCESSES IN SOLUTION USING ELECTROANALYTICAL AND OTHER RELATED TECHNIQUES] Electrochemical Analysis Section: Summary of activities, Jul. 1970 - Jun. 1971
Richard A. Durst Feb. 1973 113 p refs
(NBS-TN-583; APR-7) Avail: SOD $0.75 domestic postpaid or $0.50 GPO Bookstore

This survey of the activities in electrochemical analysis covers the period from July 1970 to June 1971. In the area of acidity measurements, work was completed on the standardization of tris(hydroxymethyl)aminomethane for use as a biologic pH buffer material and standard for clinical pH measurements. High precision coulometry was used to determine the atomic weight of zinc, the stoichiometry of gallium arsenide, and the purity of KCl and NaCl. Polarography was used to determine trace elements in a variety of environmental samples and standard reference materials. Author

N73-18154# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE EVAPORATION MECHANISM DURING POWERFUL ENERGY FLUX INTERACTION WITH A MATERIAL
V. N. Kondratev [1972] 10 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekh. Fiz. (USSR), no. 5, 1972 p 49-57
Avail: NTIS HC $3.00; National Translation Center, John Crerar Library, Chicago, Ill. 60616

Surface and volume mechanisms of material evaporation under the effect of powerful radiation fluxes are examined. Computations were made under the assumption of the presence of both fluctuating and stationary bubbles in the material, taking into account the presence of material heating ahead of an evaporation wave traveling in the depth. Dependencies of the incident energy flux density of the mean thickness of the energy liberation zone are obtained for aluminum, copper, and lead, where the transition from the surface to the volume mechanism of evaporation occurs when they are exceeded. Author

N73-18155*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE REACTION OF H2O2 WITH NO2 AND NO
David Gray, Eduardo Lissi, and Julian Heicklen 29 Mar. 1972 28 p refs
(Grants NGL-39-009-003; NSF GP-5611)
(NASA-CR-130831; PSU-IRL-SCI-391) Avail: NTIS CSCL 07D

The reactions of NO and NO2 with H2O2 have been examined at 25 C. Reaction mixtures were monitored by continuously bleeding through a pinhole into a monopole mass spectrometer. NO2 was also monitored by its optical absorption in the visible part of the spectrum. Reaction mixtures containing initially 1.5 - 2.5 torr of NO2 and 0.8 - 1.4 torr of H2O2 or 1 - 12 torr of NO and 0.5 - 1.5 torr of H2O2 were studied. The H2O2 - NO reaction was complex. There was an induction period followed by a marked acceleration in reactant removal. The final products of the reaction, NO2, probably H2O, and possibly HONO2 were produced mainly after all the H2O2 was removed. The HONO intermediate was shown to disproportionate to NO2 + NO + H2O in a relatively slow first order reaction. The acceleration in H2O2 removal after the NO - H2O2 reaction is started is caused by NO2 catalysis. Author

N73-18156*# Nevada Engineering and Technology Corp., Long Beach, Calif.
CORRELATION OF MATERIALS PROPERTIES WITH THE ATOMIC DENSITY CONCEPT Report for 27 Dec. 1972 - 21 Feb. 1973
S. W. Bradstreet 21 Feb. 1973 19 p refs
(Contract NAS8-28517)
(NASA-CR-124095; Rept-5) Avail: NTIS HC $3.00 CSCL 07D

Progress is described in developing, through mathematical expressions, values for the parameters which apparently determine the values of atomic density, melting point, and principal elastic constant for the alkali halides. This necessarily required the review and refinement of these data for the monohalides in general

and for LiH. A more sensitive and dimensionless expression of the mass factor appears to have promise and a still more sensitive one is suggested for future study. A periodicity factor based on inert gas core configuration has been suggested to replace the atomic number previously used. Author

N73-18157*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROPHORESIS DEMONSTRATION ON APOLLO 16
R. S. Snyder Nov. 1972 47 p refs
(NASA-TM-X-64724) Avail: NTIS HC $4.50 CSCL 07D

Free fluid electrophoresis, a process used to separate particulate species according to surface charge, size, or shape was suggested as a promising technique to utilize the near zero gravity condition of space. Fluid electrophoresis on earth is disturbed by gravity-induced thermal convection and sedimentation. An apparatus was developed to demonstrate the principle and possible problems of electrophoresis on Apollo 14 and the separation boundary between red and blue dye was photographed in space. The basic operating elements of the Apollo 14 unit were used for a second flight demonstration on Apollo 16. Polystyrene latex particles of two different sizes were used to simulate the electrophoresis of large biological particles. The particle bands in space were extremely stable compared to ground operation because convection in the fluid was negligible. Electrophoresis of the polystyrene latex particle groups according to size was accomplished although electro-osmosis in the flight apparatus prevented the clear separation of two particle bands. Author

N73-18158# General Electric Co., Santa Barbara, Calif. DASIAC.
REACTION RATE DATA, NUMBER 36. ANNUAL SUMMARY OF PROGRESS IN FY 1972 DNA REACTION RATE PROGRAM
Sep. 1972 41 p refs
(Contract DASA01-70-C-0035)
(AD-753246) Avail: NTIS CSCL 07/4

The document is composed of annual summary research reports for FY 1972 of the Defense Nuclear Agency comprising information and data on atomic and molecular reactions and on interactions of importance in the upper atmosphere. GRA

N73-18159# Analytical Research Labs., Inc., Monrovia, Calif.
TRACE ANALYSES OF HUMAN BREATH SAMPLES Final Report, 19 Oct. - 9 Dec. 1971
Carl L. Deuel and Milton L. Moberg Brooks AFB, Tex. School of Aerospace Medicine. Sep. 1972 50 p refs
(Contract F41609-67-C-0051; AF Proj. 7930)
(AD-750141; SAM-TR-72-18) Avail: NTIS CSCL 07/4

A series of human breath samples were cryogenically collected to determine trace constituents. Thirteen sets of samples were obtained by direct breathing, and three sets were obtained from an experimental rebreathing system. Gas chromatographic and mass spectrometric analyses identified some 93 compounds and their concentrations. The rebreathing system evidently concentrated some of these constituents. Author (GRA)

N73-18160# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY OF THE DENSITY OF FREON-11
S. L. Rivkin, E. A. Kremenevskaya, and R. E. Baran 19 Oct. 1972 12 p ref Transl. into ENGLISH from Teplofizicheskie Svoistva Zhdkostei (Moscow), 1970 p 7-10
(AF Proj. 7343)
(AD-752863; FTD-HT-23-808-72) Avail: NTIS CSCL 07/4

The density of liquid Freon-11 (chloro-difluoromethane) was determined at 0 to 200C and 8.18 to 195.46 atm pressure. The results of 173 experiments are presented in both tabular and graphic form. Author (GRA)

N73-18161# Xerox Electro-Optical Systems, Pasadena, Calif.
CHARGE TRANSFER CROSS SECTIONS OF THE ALKALI METALS Final Report, 24 Oct. 1970 - 1 Sep. 1972
Julius Perel and Howard L. Daley Oct. 1972 25 p refs
(Contract DAHC04-69-C-0055)
(AD-752909; AROD-5870-16-P) Avail: NTIS CSCL 07/4

Measurements were made of total charge transfer cross sections and cross sections for transfer to specific excited states over an approximate range from 0.5 to 25 keV. The measurements involved most combinations of alkali metals. The experimental methods are described briefly including the apparatus developed, but not yet used, to measure differential cross sections. The experimental results are briefly summarized with references of publications included for each. Example cross section determinations are given of the experimental determinations. The impact of these measurements upon theoretical work at other laboratories is discussed. Author (GRA)

N73-18162# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
VACUUM SUBLIMATION OF AMMONIUM PERCHLORATE
Steve Tang and John B. Fenn (Yale Univ.) Nov. 1972 23 p refs
(Contract N00014-67-A-0226-0005: NR Proj. 098-038)
(AD-753219; SQUID-TR-YALE-1-PU) Avail: NTIS CSCL 07/4

Time-of-flight measurements have been made on the flux of molecules from the surface of ammonium salts vaporizing into vacuum. As expected with ammonium halides and ammonium bi-sulfate the TOF distributions correspond to equimolar fluxes of ammonia and the corresponding acid. In the case of ammonium perchlorate the vapor subliming from a single crystal comprised ammonia and perchloric acid. When the source was compressed powder, the vapor was a mixture of lower molecular weight species. This result seems best explained in terms of subsurface decomposition. Author (GRA)

N73-18163# Purdue Univ., Lafayette, Ind.
A REVIEW OF EXPERIMENTAL MEASUREMENT METHODS BASED ON GAS-PHASE CHEMILUMINESCENCE
Arthur Fontijn, Dan Golomb, and Jimmie A. Hodgeson Nov. 1972 44 p refs Prepared in cooperation with AeroChem Res. Labs., Inc. Submitted for publication
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID)
(AD-753222; SQUID-TR-AC-12-PU; AEROChem-TP-283) Avail: NTIS CSCL 07/4

Measurement methods based on gas-phase chemiluminescence have found extensive use in a wide variety of disciplines such as homogeneous and heterogeneous reaction kinetics, thermochemistry, gas dynamics, aeronomy, analytical chemistry and air pollution (source and ambient atmospheric monitoring). Chemiluminescence intensity measurements are used to determine reactant and/or product concentrations from which are derived rate coefficients, diffusion coefficients, densities, wall recombination coefficients and heats of formation. Such measurements also allow temperature determinations. In the review, the various methods and reactions are discussed in the context of their specific applications. The majority of the report concerns itself with chemiluminescence used in air pollution monitoring and chemical release studies in the upper atmosphere. GRA

N73-18164# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFRARED ABSORPTION SPECTRA OF ALUMINUM, GALLIUM AND INDIUM SUBOXIDE VAPORS. SOME REGULARITIES IN FREQUENCIES OF OSCILLATIONS OF SUBOXIDES OF ELEMENTS OF THE 3 GROUP AND EVALUATION OF MOLECULAR CONSTANTS OF B2O
A. A. Maltsev and V. F. Shevelkov 27 Oct. 1972 13 p refs Transl. into ENGLISH from the book "Kolebatelnye Spektry v Neorgan. Khim." Moscow, Izd-vo Nauka, 1971 p 89-92
(AF Proj. 7360)
(AD-752861; FTD-HT-23-981-72) Avail: NTIS CSCL 07/4

Absorption bands of IR spectra of Al2O, Ga2O, In2O, Tl2O, and B2O were assigned and frequencies of fundamental vibrations were determined. Distances between the metal and oxygen in Al2O and B2O were estimated. GRA

N73-18165# Georgia Inst. of Tech., Atlanta.
INTERFACE PHENOMENA IN ENGINEERING MATERIALS Final Report
Edwin J. Scheibner 31 Oct. 1972 26 p refs
(Contract F44620-68-C-0008; AF Proj. 7921; Proj. Themis)
(AD-753099; AFOSR-72-2029TR) Avail: NTIS CSCL 07/4

Research is summarized whose purpose was to examine in a fundamental manner various phenomena occurring at interfaces

between different materials, including the gas-solid interface, and their influence on the behavior of materials in engineering applications. The research program included fundamental surface science, e.g., adsorption and surface thermodynamics; the development of surface analytical techniques, e.g., Auger electron spectroscopy and micromechanical techniques; applications, e.g., friction and wear, and semiconductor process studies; and fabrication methods, e.g., chemical vapor deposition and sintering. Author (GRA)

N73-18166# Case Western Reserve Univ., Cleveland, Ohio. Ultrasonics Research Lab.
RAYLEIGH-BRILLOUIN INTENSITY RATIOS IN AQUEOUS ELECTROLYTE SOLUTIONS
Arthur R. Maret and Ernest Yeager 1 Nov. 1972 32 p refs (Contract N00014-67-A-0404-0004; NR Proj. 384-305) (AD-753017; TR-41) Avail: NTIS CSCL 07/4

Rayleigh-Brillouin intensity ratios have been measured for a number of aqueous electrolytic solutions as a function of concentration. The calculated and experimental intensity ratios are in agreement within the experimental precision for solutions of alkali metal and alkali earth halides and nitrates at concentrations up to 3 M, thus confirming applicability of simple concentration fluctuation theory for such systems. In solutions of 2-2 sulfates the observed intensity ratios are significantly higher than the calculated values; the descrepancy remains to be explained although pronounced ionic association may be a factor.
Author (GRA)

N73-18167# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EVAPORATION OF A WATER DROP BEING ACTED UPON BY A LIGHT PULSE
A. B. Kuzilovskii, V. A. Pogodaev, and S. S. Khmelevtsov 23 Oct. 1972 14 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 20, no. 1, 1971 p 21-25
(AD-752822; FTD-HT-23-898-72) Avail: NTIS CSCL 07/4

The dynamics of a water drop evaporated by heating with a laser pulse was investigated using high-speed filming. The curves for dependence of the drop radius on time and those of radius change depending on energy radiation current are in fine agreement with theoretical formulae. The measured values of the explosion threshold of the drops are in close agreement with those estimated. GRA

N73-18168# National Academy of Sciences-National Research Council, Washington, D.C.
PROCEEDINGS OF A SYMPOSIUM ON AN APPRAISAL OF HALOGENATED FIRE EXTINGUISHING AGENTS
1972 350 p refs Conf. held at Washington, D.C., 11-12 Apr. 1972
(AD-753218) Avail: NTIS CSCL 13/12

The report presents the papers given at the symposium and consists essentially of two groups: Toxicology and Performance. The topics covered include: Principles and procedures for toxicologic and physiologic evaluation of the Safety of Materials; Use of human volunteers; Inhalation injuries in fires; Toxicology of pyrolysis products of halogenated agents; Toxicology of Halon 1211; Halon 1301; Cardiovascular and nervous system effects of Bromotrifluoromethane; Use of Halon 1301 in surface and deep-seated fires, aircraft cabin, and cargo fires, gasoline fires, shipboard fires, submarine fires, and explosions and propellant fires; and the Use of Halon 1211 in hand extinguishers and fixed systems. GRA

N73-18169# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATION CHEMISTRY AND CABLE TECHNOLOGY
E. E. Finkel, S. S. Leshchenko, and R. P. Braginskii 17 Aug. 1972 387 p refs Transl. into ENGLISH from the book "Radiats. Khim. i Kabelnaya Tekh." Moscow, Atomizdat, 1968 p 1-312
(AD-753367; FTD-MT-24-1916-71) Avail: NTIS CSCL 07/5

The scientific and technical principles of the radiation modification of electrical insulating polymeric materials used in electrotechnical (mainly in cable), radio engineering, and the electronic industry are presented. An analysis is made of the physicochemical bases for the use of ionizing radiations for the modification of properties of polymers, the essence of radiochemical processes flowing in them during irradiation, and the peculiarities of action of radiation of various forms. Fundamental information on the radiation chemistry of polymeric systems is given and a detailed examination is made of the characteristics of radiation-modified electrical insulating polymeric materials under specific operating conditions. Author (GRA)

N73-18674 Atomic Energy of Canada Ltd., Chalk River (Ontario).
TECHNIQUES TO STUDY TRANSPORT PHENOMENA IN ANODIC OXIDES
F. Brown *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 23-26 refs (For availability see N73-18668 09-22)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-18170 British Broadcasting Corp., Kingswood (England). Research Dept.
PULSE CODE MODULATION FOR HIGH QUALITY SOUND SIGNAL DISTRIBUTION: SUBJECTIVE EFFECT OF DIGIT ERRORS
G. R. Mitchell and M. E. B. Moffat 1972 10 p refs
(BBC-1972/40) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A digit-error-protection technique for use in a multiplex pulse-code modulation PCM system for high quality sound-signal distribution is briefly summarized. Tests were carried out with and without the application of the protection technique to assess the impairment caused to critical program material when random errors were introduced into the PCM signal. It was found that the technique afforded acceptable transmission performance at bit-error probabilities up to about 0.00001. This represents a useful improvement over the performance with an unprotected channel. Author

N73-18171*# Auburn Univ., Ala. Microwave Research Lab.
STUDIES RELATING TO FM TELEVISION AND TELEMETRY TRANSMITTERS Annual Report
W. P. Albritton and M. A. Honnell Oct. 1972 68 p ref
(Contract NAS8-26193)
(NASA-CR-124082) Avail: NTIS HC $5.50 CSCL 09F

The Auburn University Model S-2 FM television transmitter was examined to determine if the performance and reliability could be improved by application of new techniques and devices developed since completion of the original design work. In particular this study examined the possibility of increased use of integrated circuits. It was determined that improvements in both performance and reliability were possible. In addition a study was conducted to determine the feasibility of converting the transmitter to handle telemetry signals. The study revealed that this conversion was feasible and the modifications were made to the prototype model for verification. Author

N73-18172*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
STUDY OF MATHEMATICAL MODELING OF COMMUNICATION SYSTEMS TRANSPONDERS AND RECEIVERS Final Report
J. R. Walsh 19 Nov. 1972 201 p refs
(Contract NAS8-28148; Proj. A-1379)
(NASA-CR-124097) Avail: NTIS HC $12.25 CSCL 17B

The modeling of communication receivers is described at both the circuit detail level and at the block level. The largest effort was devoted to developing new models at the block modeling level. The available effort did not permit full development of all of the block modeling concepts envisioned, but idealized blocks were developed for signal sources, a variety of filters, limiters, amplifiers, mixers, and demodulators. These blocks were organized into an operational computer simulation of communications receiver circuits identified as the frequency and time circuit analysis technique (FATCAT). The simulation operates in both

the time and frequency domains, and permits output plots or listings of either frequency spectra or time waveforms from any model block. Transfer between domains is handled with a fast Fourier transform algorithm. Author

N73-18173# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A MAXIMUM-LIKELIHOOD MULTIPLE-HYPOTHESIS TESTING ALGORITHM, WITH AN APPLICATION TO MONOPULSE DATA
E. J. Kelly Feb. 1973 27 p refs
(Contracts DOT-FA72WAI-261; F19628-73-C-0002; FAA Proj. 034-241-012)
(TN-1973-7) Avail: NTIS HC $3.50

A simple algorithm for multiple-hypothesis testing, based on a generalization of likelihood ratio testing between paris of hypotheses, is developed and applied to a specific problem. The problem arises in connection with an amplitude comparison monopulse system in an Air Traffic Control application. In particular, it is desired to measure target azimuth in a beacon system in the presence of interference and multipath. The multiple hypotheses relate to the presence or absence of a desired signal, with or without either of two kinds of interfering signal. The analysis leads to a new technique of data editing, or processing, to detect the presence of interference. Author

N73-18174*# Kanner (Leo) Associates, Redwood City, Calif.
POLARIZATION OF RADIO WAVES REFLECTED FROM THE INHOMOGENEOUS IONOSPHERE
Yu. V. Morozov Washington NASA Feb. 1973 10 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3: Fiz.-Astron. (Moscow), v. 13, no. 4, Jul.-Aug. 1972 p 454-457
(Contract NASw-2481)
(NASA-TT-F-14676) Avail: NTIS HC $3.00 CSCL 20N

Calculations show that there is a very small difference between the true mean field polarization of radio waves reflected from the inhomogeneous ionosphere and that calculated using Stokes parameters. A Stokes parameter system is derived, from which the wave depolarization coefficient can be found. It turns out to be about 0.001. Formulas for finding the angle of rotation and polarization ellipse axes are derived. Stokes parameters can be used with high accuracy in determining the polarization characteristics of the reflected waves and the mean field polarization. Author

N73-18175*# Translation Consultants, Ltd., Arlington, Va.
SPACE RADIOTELEMETRY
V. N. Kurskiy Washington NASA Feb. 1973 166 p refs Transl. into ENGLISH of the book "Kosmicheskaya Radiotelemetriya" Moscow, Nauka Press, 1971
(Contract NASw-2038)
(NASA-TT-F-722) Avail: NTIS HC $3.00 CSCL 09F

An introduction is presented to the principal problems, requirements, and operating conditions of space radio telemetry systems. Problems of equipment reliability, weight, power sources, and interference-free communication with spacecraft in near and deep space are considered. In addition, the use of on-board systems for the storage of telemetric and video information, preliminary data processing and compression, and reliable transmission, are shown to constitute the highest priority of mandatory dependability. J.M.M.

N73-18176# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ATC SURVEILLANCE/COMMUNICATION ANALYSIS AND PLANNING Quarterly Technical Summary, 1 Sep. - 30 Nov., 1972
1 Dec. 1972 46 p refs
(Contracts DOT-FA72WAI-242; F19628-70-C-0230)
(FAA-RD-72-136) Avail: NTIS HC $4.50

Analysis and planning activities reported include: (1) analyses of S/C requirements, near miss/collision data, desirable weather data processing and display systems, recorded data from an operational ATCRBS/ARTS-3 site; (2) a quasi-step-scan radar technique potentially capable of improving the clutter rejection performance of existing ATC radars; and (3) the status of a test program to obtain and analyze data on the effects of cyclically switching between transponder antennas. Author

N73-18177*# Auburn Univ., Ala.
AUTOMATIC FREQUENCY CONTROL FOR FM TRANSMITTER Patent Application
Martial A. Honnell, inventor (to NASA) Filed 20 Feb. 1973 18 p Sponsored by NASA
(NASA-Case-MFS-21540-1; US-Patent-Appl-SN-333912) Avail: NTIS HC $3.00 CSCL 17B

An automatic frequency control circuit for an FM television transmitter is described in which the frequency of the transmitter is sampled during what is termed the back porch portion of the horizontal synchronizing pulse which occurs during the the retrace interval. The frequency sample is compared with the frequency of a reference oscillator, and a correction applied to the frequency of the transmitter during this portion of the retrace interval. NASA

N73-18178*# General Electric Co., Syracuse, N.Y. Electronics Lab.
LOW COST GROUND RECEIVING SYSTEMS FOR TELEVISION SIGNALS FROM HIGH POWERED COMMUNICATIONS SATELLITES, VOLUME 1 Final Report
J. P. Hesler, Y. C. Hwang, and J. J. Zampini [1972] 161 p ref
(Contract NAS3-11520)
(NASA-CR-120933) Avail: NTIS HC $10.25 CSCL 09F

The fabrication and evaluation of 10 engineering prototype ground signal processing systems of three converter types are reported for use with satellite television. Target cost converters and cost sensitivity analysis are discussed along with the converter configurations. F.O.S.

N73-18179# Lockheed Missiles and Space Co., Palo Alto, Calif.
INDEPENDENT RADAR SYSTEMS, CHAPTER 6
D. S. Kontorov and Iu. S. Golubov-Novozhilov [1972] 15 p refs Transl. into ENGLISH from the book "Vvedenie v Radiolokatsionnuiu Sistemotekhniku" Sovetskoe Radio, Moscow, 1971 p 167-184
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The design and construction of independent radar systems to determine target motion and nonkinematic parameters are discussed. The system is comprised of a peripheral information source, a central information processor, and a communication subsystem, together with a correlation matrix to measure target parameter error. It is concluded that independent systems using circular scan radars are apparently the most feasible, and the most practical application is found in air traffic control systems. J.M.M.

N73-18180# Lockheed Missiles and Space Co., Palo Alto, Calif.
CORRELATION PROPERTIES OF A PHASE-MANIPULATED SIGNAL WHICH HAS PASSED A n-STAGE RESONANCE FILTER
V. I. Vinokurov and R. A. Vakker [1972] 4 p Transl. into ENGLISH from the book "Voprosy Obrabotki Slozhykh Signalov v Korreliatsionnykh Sistemakh" Moscow, Sovetskoe Radio, 1972 p 194-199
Avail: NTIS HC $3.00, National Translation Center, John Crerar Library, Chicago, Ill. 60616

Passband and resonance frequency influence on shifts in the nature of autocorrelation properties of a phase manipulated signal is examined. The signal is passed through an n-stage resonance filter. E.H.W.

N73-18181# Lockheed Missiles and Space Co., Palo Alto, Calif.
CORRELATION SYSTEMS, CHAPTER 3
V. I. Vinokurov and R. A. Vakker [1972] 17 p Transl. into ENGLISH from the book "Voprosy Obrabotki Slozhnykh Signalov v Korreliatsionnykh Sistermakh" Moscow, Sovetskoe Radio, 1972 p 69-91
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A correlation system is defined as a system whose operation is based on the use of the correlation method for signal processing in the presence of interference noise. Radio electronic methods to minimize interference effects constitute correlation detection with noise locator analysis, pseudo-random signal analysis, passive

signal analysis, time resolution and compression methods, and correlation of reflected with radiated signals. G.G.

N73-18182# Aerospatiale Usines de Toulouse (France).
ORIENTATION PRECISION OF THE SYMPHONIE TELECOMMUNICATION ANTENNAS [PRECISION D'ORIENTATION DES ANTENNES DE TELECOMMUNICATIONS DE SYMPHONIE]
H. P. Nguyen and M. Chognot 1972 33 p In FRENCH Presented at the 5th DGLR Ann. Meeting, Berlin, 3-6 Oct. 1972
(DGLR-Paper-72-063) Avail: NTIS HC $3.75

Orientation of the Symphonie communication satellite antennas is discussed. The radiation balance of the antennas is evaluated as a function of attitude control and position errors. Tolerances in antenna geometry and attitude control of three-axis stabilized satellites are also discussed. ESRO

N73-18183# Gesellschaft fuer Weltraumforschung m.b.H., Porz (West Germany).
SYSTEM LAYOUT AND PLANNING FOR A TELEVISION BROADCASTING SATELLITE [SYSTEMAUSLEGUNG UND PLANUNG FUER EINEN FERNSEHRUNDFUNKSATELLITEN]
H. Billig 1972 20 p refs In GERMAN Presented at the 5th DGLR Ann. Meeting, Berlin, 4-6 Oct. 1972
(DGLR-Paper-72-051) Avail: NTIS HC $3.00

A television broadcasting system via satellite is described which is capable, when linked with local cable networks, of meeting growth requirements for television program transmission forecast by the German postal authorities. This system presents an attractive and relatively economic solution which would make transmission possible to all consumers in the receiving zone. A development and a test program using an experimental satellite are proposed. ESRO

N73-18184# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
SPACE-TIME RELATIONSHIPS IN ECHO WAVE FIELDS
F. Wiekhorst Aug. 1972 22 p Presented at the NATO Advan. Study Inst. on Signal Process., Loughborough, Engl., 21 Aug. - 1 Sep. 1972
(Contract T-0230-02320-01127)
(Rept-1-72) Avail: NTIS HC $3.25

The space-time relationship in echo structure analysis as a means of target classification is considered with simple examples. It is assumed that the wavefield distribution around a target is unknown except for some imposed restrictions. It is shown that certain characteristics in a suitable chosen plot depend only on these restrictions. This implies that a target can be classified by detecting the restrictions rather than by focussing on the actual scatter distribution. ESRO

N73-18185# Naval Electronics Lab. Center, San Diego, Calif.
COMPENDIUM OF SPEECH TESTING MATERIAL AND TYPICAL NOISE SPECTRA FOR USE IN EVALUATING COMMUNICATIONS EQUIPMENT
J. C. Webster 13 Sep. 1972 100 p refs
(AD-753207; NELC-TD-191) Avail: NTIS CSCL 17/2

The compendium of speech tests and typical naval noise spectra was assembled to meet the recurring need for good speech tests for evaluation of speech communication systems. Because of the complex nature of spoken language, many facets of language and test design must be specified before a quantitative score has meaning. These points are treated briefly, and published material is referenced for the reader who has need for further details. Author (GRA)

N73-18186# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SUMMARY OF THE SYSTEM, SUPPORT, AND SPECIAL PURPOSE SOFTWARE USED BY THE SANGUINE SIMULATION FACILITY
Ira Richer and Dale A. McNeill 18 Sep. 1972 139 p refs
(Contract F19628-73-C-0002; AF Proj. 150A)
(AD-753115; TN-1972-31; ESD-TR-72-234) Avail: NTIS CSCL 17/2

A computer facility, consisting of a Varian 620/i digital computer, associated peripherals, and extensive software, has been developed for analyzing and simulating communications systems. The software includes an operating system, general-purpose subroutines, and simulation programs. The report describes the software in detail, serving as a handbook for potential users and as a guide for setting up similar facilities. Author (GRA)

N73-18187# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Microwave Physics Lab.
CHEMICAL INJECTION INTO A REENTRY PLASMA TO IMPROVE HIGH POWER EM WAVE TRANSMISSION Interim Report
Robert J. Papa 18 Sep. 1972 36 p refs
(AF Proj. 5635)
(AD-753077; AFCRL-72-0556; PSRP-511) Avail: NTIS CSCL 20/14

For purposes of electronic countermeasures, it is desirable to maximize the amount of power that can be transmitted from a reentry vehicle by suppressing the onset of antenna voltage breakdown. This can be accomplished by injecting chemicals into the reentry plasma sheath. The report describes a numerical procedure for calculating the amount of power that can be transmitted through a chemically seeded plasma. The power levels of a plane electromagnetic wave incident on a reentry plasma slab are sufficient to induce electron temperature changes. As a result, the electron density and effective collision frequency vary with time. Author (GRA)

N73-18188# Naval Electronics Lab. Center, San Diego, Calif.
PHASE VELOCITIES FOR DAY AND NIGHT Technical Document, Oct. 1971 - Apr. 1972
Oct. 1971 - Apr. 1972
W. D. Westfall and J. A. Ferguson 20 Oct. 1972 45 p refs
(XR0080101; NELC Proj. M203)
(AD-753206; NELC-TD-182) Avail: NTIS CSCL 17/2

Measurements of phase velocity at VLF are made using separated time- and phase-synchronized receivers to obtain phase differentials, and such measurements are compared with theoretical values. Daytime measurements of VLF phase velocity are found to be in good agreement with theoretical values, within the accuracy permitted by the known distance between the receiving sites and an assumed horizontally homogeneous ionospheric model. It is also determined that measured values of phase velocity at night and also at transition times (sunrise and sunset) cannot be effectively compared with theoretical values unless a time-varying ionospheric model is employed. Author (GRA)

N73-18189# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.
REPRESENTATION AND ESTIMATION TECHNIQUES FOR CYCLOSTATIONARY RANDOM PROCESSES
L. E. Franks Nov. 1972 18 p refs
(Grant AF-AFOSR-2388-72; AF Proj. 9769)
(AD-753132; AFOSR-72-2388TR) Avail: NTIS CSCL 09/4

Many communication and control systems employ signal formats that involve some form of periodic processing operation. Familiar examples are signals produced by samplers, scanners, multiplexers, or modulators. Very often these signals can be modelled as cyclostationary processes, i.e., processes whose statistical properties, such as mean and autocorrelation, fluctuate periodically with time. Filters designed to extract signals of this type from a noise background can exhibit dramatically improved performance when the periodic nature of the statistics are taken into account, rather than using the more conventional time-average statistical approach. Some techniques for solving for the optimum filter and a video signal example are discussed. Author (GRA)

N73-18190# Innsbruck Univ. (Austria). Electronics Lab.
REMARKS ON ELLIPTICALLY POLARIZED ROTARY FIELDS Interim Scientific Report
Norbert Nessler 1 Aug. 1972 31 p refs
(Contract F44620-72-C-0052; AF Proj. 4600)
(AD-753085; AFCRL-72-0598; SR-2) Avail: NTIS CSCL 20/14

The general case of superposition of several H-components of VLF signals having the same frequency is examined at one point of reception. The existence of only one rotating field is proved. The measurements required for an exact determination of the position in space of the ellipse (3 angles) as well as of

the 2 voltages proportional to the two main axes of the ellipse are described and calculated analytically. The error that may arise under certain conditions of measurement is estimated.
Author (GRA)

N73-18191# Naval Intelligence Support Center, Washington, D.C. Translation Services Div.
DETECTING A POINT RADIATOR IN THE PRESENCE OF NONGAUSSIAN INTERFERENCE
M. Kh. Reznik 16 Nov. 1972 10 p refs Transl. into ENGLISH from Opt.-Mekh. Prom. (Leningrad), no. 3, 1972 p 3-6
(AD-752712; NISC-TRANS-3366) Avail: NTIS CSCL 09/4

An optimal method of detecting a pulse signal in the presence of background interference of the kind presented by cloudy sky radiation characterized by a nongaussian distribution law is described. Author (GRA)

N73-18192# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
RADAR CROSS-SECTION MEASUREMENTS OF SNOW AND ICE
Pieter W. Hoekstra and Dennis Spanogle Nov. 1972 45 p refs
(ARPA Order 1615)
(AD-752900; CRREL-TR-235) Avail: NTIS CSCL 17/9

The radar backscatter from undisturbed snow surfaces was measured at 10 GHz, 35 GHz and 95 GHz and at grazing angles of 1 to 0.4 degrees. For horizontally polarized radiation the ground clutter per unit area (m squared) at 10 GHz from a flat snow terrain decreased from -50 db at 1 degree to -70 db at 0.4 degrees. The return was approximately 10 db lower for vertically polarized radiation. The ground clutter depended on the free water content of the snow. The radar cross section of ice blocks placed on the snow surface was roughly proportional to the square of the area of the ice blocks facing the radar at 10 and 35 GHz and was about 20 dbsm below the return expected for a perfectly reflecting plane surface. At 95 GHz the ice blocks became diffuse reflectors. Author (GRA)

N73-18193# Naval Research Lab., Washington, D.C. Radar Geophysics Branch.
RADAR/RADIO TROPOSPHERIC ABSORPTION AND NOISE TEMPERATURE Final Report
Lamont V. Blake 30 Oct. 1972 85 p refs
(AD-753197; NRL-7461) Avail: NTIS CSCL 20/14

Fortran digital-computer routines to calculate absorption loss for radiowave propagation in the troposphere have been developed, and machine plots of radar attenuation as a function of range have been made for a standard atmosphere, over the frequency range 100 MHz to 100 GHz. The tropospheric noise temperature has also been calculated and plotted. This work is an updating of earlier calculations that were less accurate, especially in the frequency range above 10 GHz. Separate curves for the oxygen and water-vapor components of the absorption loss are provided in addition to the curves for total loss; this allows the loss for values of water-vapor density other than the standard 7.5 g/cu m to be found, by applying a simple multiplicative factor. The computer routines, listed at the end of the report, have also been used as part of a computer program to calculate the maximum range of a radar system. Author (GRA)

N73-18194# Radio Corp. of America, Somerville, N.J. Solid State Div.
LONG-LIFE, BROADBAND, COMMON-BASE, 30- TO 80-MHz VHF STAGES Final Report, 16 Feb. 1971 - 16 May 1972
Lance J. Holmquest Aug. 1972 41 p
(Contract DAAB07-71-C-0139; DA Proj. 1H6-62705-A-056)
(AD-752444; ECOM-0139-F) Avail: NTIS CSCL 09/5

A broadband, 30- to 80-megahertz, common-base transistor amplifier chain, capable of supplying 40 watts of output power with 1 6-db gain was developed. For a fixed input power of 1 watt, the output power remains within 0.6 db of the 40-watt limit across the entire frequency range. The chain consists of two stages' the first stage uses a 2N5071 to supply 10 db gain, and the output stage uses two 2N5071's in push-pull configuration to supply 6-db gain and 40 watts. The transistors were specifically fabricated with the base connected to the package to minimize baselead inductance. The amplifiers were tested both individually and as a chain for operation under load-mismatch and collector-overvoltage stress conditions. Author (GRA)

N73-18195# Army Electronics Command, Fort Monmouth, N.J.
LIGHTNING AND HIGH VOLTAGE SURGE PROTECTION FOR BALANCED DIGITAL TRANSMISSION DEVICES
John Erickson Sep. 1972 43 p refs
(DA Proj. 1S6-62703-A-056)
(AD-752448; ECOM-4027) Avail: NTIS CSCL 17/2

This report describes the development, test, and evaluation of protection for Balanced Digital Transmission Devices (BDTD) against the destructive eifects of direct and indirect lightning surges and other foreign potentials. The report includes a discussion of voltage surges on transmission lines, surge protectors, examples of existing protection techniques used successfully in specific systems, and a description of the surge test equipment. Test data obtained on performance of the developed protection installed in the BDTD package, and protection criteria for the BDTD power supply are presented in detail. Author (GRA)

N73-18196# California Inst. of Tech., Pasadena. Antenna Lab.
MULTISTREAM INTERACTIONS IN STRATIFIED AND SPACE TIME PERIODIC MEDIA
Charles Elachi Sep. 1972 29 p refs
(Grant AF-AFOSR-1935-70)
(AD-753690; TR-65; AFOSR-72-1719TR) Avail: NTIS CSCL 20/14

Multistream interactions are studied when the propagation medium (dielectric or plasma) is stratified or space-time periodic (i.e., the medium parameters behave like alpha(z,t) = (alpha sub 0) (1+eta f(Kz-omega t)) where f(xi) is a periodic function). The space-time periodicity can be considered as due to a strong pump wave. The types of interactions were determined using different methods: Taylor series development, power flow method (with conservation of energy and momentum), and a numerical method based on the wave equation solution. The Brillouin diagram in the limit eta approaches 0 is used to investigate different aspects of the problem without extensive computations. It is found that all types of interactions, stable and unstable, can occur even if they did not exist in the homogeneous case.
Author (GRA)

N73-18197# Naval Electronics Lab. Center, San Diego, Calif.
SIMULTANEOUS FM-CW RADAR AND LIDAR PROBING OF THE ATMOSPHERE Research and Development Report, 15 Nov. 1971 - 30 Jun. 1972
V. R. Noonkester, D. R. Jensen, and J. H. Richter 1 Nov. 1972 146 p refs
(WR03302001; NELC Proj. M111)
(AD-753813; NELC-TR-1849) Avail: NTIS CSCL 04/2

Two new remote sensors, the NELC-developed FM-CW radar and Stanford Research Institute's laser radar, were operated simultaneously from 30 Nov 1971 to 14 January 1972 to establish their capabilities and limitations. Nine days of data were obtained by recording techniques which produced records having the same time and height scales. Author (GRA)

N73-18198# Army Missile Command, Redstone Arsenal, Ala. Systems Research Directorate.
A PRELIMINARY INVESTIGATION OF A MULTIPLE CHANNEL SIDELOBE CANCELLER
Franklin M. Waddle Sep. 1972 49 p
(DA Proj. 1X2-63302-D-212)
(AD-753571; RS-TR-72-2) Avail: NTIS CSCL 17/4

The report presents the results of a preliminary mathematical and computer analysis of a multiple channel sidelobe canceller. A mathematical expression is derived for the output of the sidelobe canceller, and a computer program is used in investigating its performance in a variety of situations. The improvement in signal-to-interference ratio is used to gauge the performance of the sidelobe canceller. Author (GRA)

N73-18199# Naval Postgraduate School, Monterey, Calif.
THE DESIGN AND PERFORMANCE OF A CIRCUIT TO MEASURE THE TUNING ERROR OF SINGLE SIDEBAND RADIO RECEIVERS M.S. Thesis

David Allan Jones Sep. 1972 43 p refs
(AD-753612) Avail: NTIS CSCL 17/2

A circuit which generates a sinusoidal voltage of the same frequency as the tuning error is examined analytically and experimentally. The design of the circuit is based on the principle that vowel sounds in human speech are periodic. The inputs to the circuit are the audio output of the SSB receiver for which the tuning error is desired and the audio output of an envelope detector which amplitude demodulates the SSB radio signal. The envelope detector provides a reference signal which is a harmonic of the fundamental modulating frequency of the SSB radio signal. This reference signal and the SSB receiver audio are nonlinear processed to generate the error voltage. Receiver tuning errors as small as 0.1 Hertz were measured using this circuit.
Author (GRA)

N73-18200# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADAR CROSS SECTION OF A PYRAMID WITH NODES
William H. Schoendorf 16 Nov. 1972 83 p refs
(Contract F19628-73-C-000Z; AF Proj. 627A)
(AD-753684; TN-1972-25; ESD-TR-72-260) Avail: NTIS CSCL 17/9

High-frequency scattering by a perfectly conducting N-noded pyramid is investigated. The principally polarized radar cross section is derived by integrating the fields scattered from a wedge around the base termination and, also, the longitudinal edges. The theoretical results are compared with measurements and shown to be in reasonable agreement. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-18201*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POOLMS: A COMPUTER PROGRAM FOR FITTING AND MODEL SELECTION FOR TWO LEVEL FACTORIAL REPLICATION-FREE EXPERIMENTS
Geraldine E. Amling and Arthur G. Holms Washington Feb. 1973 29 p refs
(NASA-TM-X-2706; E-7142) Avail: NTIS HC $3.00 CSCL 09B

A computer program is described that performs a statistical multiple-decision procedure called chain pooling. It uses a number of mean squares assigned to error variance that is conditioned on the relative magnitudes of the mean squares. The model selection is done according to user-specified levels of type 1 or type 2 error probabilities. Author

N73-18202*# Computer Sciences Corp., Huntsville, Ala.
PROCESSING FOR SPACEBORNE SYNTHETIC APERTURE RADAR IMAGERY
M. Lybanon Washington NASA Feb. 1973 105 p refs
(Contract NAS8-21805)
(NASA-CR-2193; M540) Avail: NTIS HC $3.00 CSCL 09E

The data handling and processing in using synthetic aperture radar as a satellite-borne earth resources remote sensor is considered. The discussion covers the nature of the problem, the theory, both conventional and potential advanced processing techniques, and a complete computer simulation. It is shown that digital processing is a real possibility and suggests some future directions for research. Author

N73-18203*# South Dakota State Univ., Brookings. Remote Sensing Inst.
A COMPARATIVE STUDY OF NONPARAMETRIC METHODS FOR PATTERN RECOGNITION Interim Technical Report
Sangkoo F. Hahn and Gerald D. Nelson Nov. 1972 99 p refs
(Grant NGL-42-003-007)
(NASA-CR-130824; SDSU-RSI-72-19) Avail: NTIS HC $7.00 CSCL 06D

The applied research discussed in this report determines and compares the correct classification percentage of the nonparametric sign test, Wilcoxon's signed rank test, and K-class classifier with the performance of the Bayes classifier. The performance is determined for data which have Gaussian, Laplacian and Rayleigh probability density functions. The correct classification percentage is shown graphically for differences in modes and/or means of the probability density functions for four, eight and sixteen samples. The K-class classifier performed very well with respect to the other classifiers used. Since the K-class classifier is a nonparametric technique, it usually performed better than the Bayes classifier which assumes the data to be Gaussian even though it may not be. The K-class classifier has the advantage over the Bayes in that it works well with non-Gaussian data without having to determine the probability density function of the data. It should be noted that the data in this experiment was always unimodal. Author

N73-18204*# National Aeronautics and Space Administration, Washington, D.C.
COMPUTER PROGRAMS: INFORMATION RETRIEVAL AND DATA ANALYSIS, A COMPILATION Technology Utilization
[1972] 18 p
(NASA-SP-5955(01)) Avail: NTIS HC $1.00 CSCL 09B

The items presented in this compilation are divided into two sections. Section one treats of computer usage devoted to the retrieval of information that affords the user rapid entry into voluminous collections of data on a selective basis. Section two is a more generalized collection of computer options for the user who needs to take such data and reduce it to an analytical study within a specific discipline. These programs, routines, and subroutines should prove useful to users who do not have access to more sophisticated and expensive computer software. Author

N73-18205*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PROGRAMMABLE COMPUTER INTERFACE FOR CAMAC
Robert W. Bercaw, Theodore E. Fessler, and Jeffrey M. Arnold Washington Mar. 1973 57 p refs
(NASA-TN-D-7148; E-6957) Avail: NTIS HC $3.00 CSCL 09B

An interface has been developed for CAMAC instrumentation systems that implements data transfers controlled either by the computer CPU or by an autonomous (data-channel) processor in the interface unit. The data channel processor executes programs stored in the computer memory. These programs consist of standard CAMAC module commands plus special control characters and commands for the processor itself. The interface was built for the PDP-15 computer, which has an 18-bit word structure, but both 18- and 24-bit data transfers can be made. A software system has been written that exploits the many features of the processor. Author

N73-18206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF A HYBRID COMPUTER TO SWEEP FREQUENCY DATA PROCESSING
Edward J. Milner and William M. Bruton Washington Mar. 1973 34 p ref
(NASA-TM-X-2753; E-7232) Avail: NTIS HC $3.00 CSCL 09B

A hybrid computer program is presented which can process as many as 10 channels of sweep frequency data simultaneously. The program needs only the sine sweep signal used to drive the system, and its correponding quadrature component, to process the data. It can handle a maximum frequency range of 0.5 to 500 hertz. Magnitude and phase are calculated at logarithmically spaced points covering the frequency range of interest. When the sweep is completed, these results are stored in digital form. Thus, a tabular listing and/or a plot of any processed data channel or the transfer function relating any two of them is immediately available. Author

N73-18207# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).
PROCESSING OF DATA FROM THE FR-1 SATELLITE. PART 1: GENERAL FILE [GESTION DES DONNEES DU SATELLITE FR-1. PREMIERE PARTIE: FICHIER GENERAL]
L. Cairo 20 Jun. 1972 103 p refs In FRENCH
(GRI/NTP/100) Avail: NTIS HC $7.25

Different means of processing the FR-1 very low frequency data are presented. The data handling system is briefly reviewed and the main file of the satellite described. Different computer programs for the statistical analysis of data are presented.
Author (ESRO)

N73-18208# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
FORTRAN PROGRAMS FOR THE STATISTICAL ANALYSIS OF SIGNALS AND SYSTEMS [FORTRAN-PROGRAMME ZUR STATISTISCHEN ANALYSE VON SIGNALEN UND SYSTEMEN]
W. Stein Jul. 1972 147 p refs In GERMAN; ENGLISH summary
(Anthro-Mitt-3/72) Avail: NTIS HC $9.50; Forschungsinst. fuer Anthropotech. 6 DM

A set of FORTRAN programs for analyzing signals and systems is presented. The statistical analysis of signals is done by correlation techniques. The signal properties are described by characteristic quantities and functions such as correlation, distribution, and spectral density functions. A linear system characterization in the frequency range is deduced from these intermediate results. Characteristics of nonlinear systems are also discussed. The data input is done from magnetic tape and the output of results is done by special subroutines. The programs are constructed in a modular fashion so that they can be used individually or in any desired combination. Author (ESRO)

N73-18209# National Physical Lab., Teddington (England).
SOME EXPERIENCES WITH ON-LINE SPECTRAL ANALYSIS USING A SMALL DIGITAL COMPUTER
J. B. Roberts, D. Surry, and R. F. Johnson London Aeron. Res. Council 1972 88 p refs Supersedes ARC-33097
(ARC-CP-1225; ARC-33097) Avail: NTIS HC $6.50; HMSO £1.35; PHI $5.30

The capabilities of an on-line spectrum analysis system using a small digital computer are described. Two approaches to the digital generation of spectral estimates, the correlation techniques and the fast Fourier transformation technique, were adopted, and an appraisal of these methods is given. A full description of the physical and performance characteristics of the hardware (computer, analog to digital converter and line) is included.
ESRO

N73-18210# System Development Corp., Santa Monica, Calif.
COMPUTER ASSISTED PLANNING Final Technical Summary Report, 16 Sep. 1971 - 15 Sep. 1972
Morton I. Bernstein 15 Sep. 1972 53 p refs
(Contract DAHC15-67-C-0149; ARPA Order 1327)
(AD-752797; SDC-TM-3628/010/00) Avail: NTIS CSCL 09/2

The document reports results of applied research in four task areas: Computation and Communication Trade-Off Studies (CACTOS); vocal English data management; on-line graphic computation; and systems research and networking. Work in these areas was directed toward the development of prototype facilities for a computer-assisted planning system. These facilities include a computer-network modeling system (the CACTOS model); systems for man-machine communication and data management via speech, ordinary English, and data-tablet graphics; and an initial facility for data-sharing among existing data management systems within a computer network. The work has also involved the continuing evolution of a sophisticated time-sharing system (ADEPT/ICOS) and the implementation of protocols for communication with other Hosts over the ARPA Network. Author (GRA)

N73-18211# Perception Technology Corp., Winchester, Mass.
A REAL TIME, SMALL VOCABULARY, CONNECTED WORD SPEECH RECOGNITION SYSTEM Final Report
Huseyin Yilmaz, William Beninghof, Leon Ferber, William Park, and Henry Kellett Nov. 1972 67 p
(Contract F30602-72-C-0083)
(AD-753176; RADC-TR-72-281) Avail: NTIS CSCL 09/2

The mini-computer based, real-time, small-vocabulary, isolated-word, speech recognition system is based upon an adaptive theory of speech perception. This approach achieves 98% correct recognition of the ten digits spoken in isolation and with minimal speaker dependence. It was the object of this project to extend the same approach to the recognition of connected strings of words. This required the development of a procedure for segmenting the strings into words and the alteration of the recognition algorithm to compensate for errors introduced in the segmentation procedure. The system developed recognizes the ten digits plus two control words connected in strings of up to two seconds in duration. The duration of the string is limited only by the available memory, but could be extended considerably without any deterioration in word accuracy. This connected-word, speech recognition system achieves 90% word accuracy in strings of three and four words at a time, with minimal speaker dependence. For strings of two words at a time, the accuracy can be as high as 95-97%. Author (GRA)

N73-18212*# Maryland Univ., College Park. Computer Science Center.
A FORTRAN EXTENDED GRAPH ALGORITHMIC LANGUAGE (FGRAAL), TECHNICAL DOCUMENTATION
C. K. Mesztenyi, H. Breitenlohner, and J. C. Yeh Oct. 1972 58 p
(Grant NGL-21-002-008; Contract N00014-67-A-0239-0021; NR Proj. 044-431)
(NASA-CR-130966; AD-752504; TR-200) Avail: NTIS HC $5.00 CSCL 09/2

The report describes the implementation of FGRAAL, a FORTRAN-extended graph algorithmic language for the Univac 1108. The report contains the description of the implemented data structures for sets, lists and graphs. It summarizes the changes made for the RALPH compiler to accommodate the special statements of FGRAAL. It gives the calling sequences generated by the changed compiler. It describes the object time subroutine package. Author (GRA)

N73-18213*# Hawaii Univ., Honolulu.
THE ALOHA SYSTEM SIXTEEN CHANNEL MULTIPLEXOR PROGRAM MODULE DESCRIPTION
Wrenwick Lee May 1972 39 p refs
(Contracts NAS2-6700; F44620-69-C-0030; Grant NSF GJ-33220)
(NASA-CR-130492; AD-746064; B72-2) Avail: NTIS HC $4.00 CSCL 09/2

THE ALOHA SYSTEM multiplexor (HP 2115A) presently handles both radiolinked terminals and hard-wired terminals. Handling of the radio-linked terminals has been previously described in ALOHA SYSTEM Multiplexor Program Description, ALOHA SYSTEM Technical Report B71-3. This report describes the software module that allows up to 16 hard-wired teletypes to be connected to the HP ALOHA SYSTEM Multiplexor. Descriptions of important functions sections, communications, and various variables are given. A listing of the program module in HP Assembly language is given. Author (GRA)

N73-18214*# Hawaii Univ., Honolulu.
THE ALOHA SYSTEM
Norman Abramson Jan. 1972 36 p refs Submitted for publication
(Contracts NAS2-6700; F44620-69-C-0030; AF Proj. 9558)
(NASA-CR-130500; AFOSR-72-0386TR; AD-737117; B72-1)
Avail: NTIS HC $4.00 CSCL 09/2

The report provides a status report and description of THE ALOHA SYSTEM research project at the University of Hawaii. THE ALOHA SYSTEM involves the analysis and construction of advanced methods of random access communications in large computer-communication systems. The existing ALOHA SYSTEM computer-communication network uses two 24,000 baud channels in the UHF band. The system employs message switching techniques similar to those of the ARPANET, in conjunction with a novel form of random access radio channel multiplexing. By means of these techniques the system has the capacity to accommodate several hundred active users of alphanumeric consoles on the two channels available. Each of these users can transmit and receive at a peak data rate of 24,000 baud although the average data rate of the users must of course be considerably less. Author (GRA)

N73-18215# Naval Ship Research and Development Center, Bethesda, Md.

SAID (SPEECH ANALOG INPUT TO DIGITIZER) REFERENCE MANUAL
May 1972 105 p
(SF54532107)
(AD-753012; NSRDC-3530) Avail: NTIS CSCL 09B

SAID (Speech Analog Input to Digitizer) is a hardware research tool made up of a filter bank and related circuitry which extracts significant analog parameters from an input speech signal and provides the parameters as input to an analog-to-digital converter. This manual describes the operation and the physical layout and wiring of the various parts of SAID. Author (GRA)

N73-18216# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ANALYSIS AND SYNTHESIS OF COINCIDENCE ADDERS WITH CIRCUITS FOR GROUP CARRIES
E. A. Drozdov 27 Oct. 1972 26 p refs Transl. into ENGLISH from Tsifrovaya Vychislitelnaya Tekhn. i Progr. (USSR), no. 6, 1971 p 136-149
(AD-752816; FTD-MT-24-1144-72) Avail: NTIS CSCL 09B

The structures of combination adders with group carry circuits are studied; finite analytic dependences are produced for all the basic structures, allowing a quantitative evaluation of their characteristics of speed and apparatus composition to be performed. The necessity and principle of considering values of the input factor of the elements used in analysis and synthesis of combination adders are shown. Author (GRA)

N73-18217# Naval Postgraduate School, Monterey, Calif.
A SURVEY AND ANALYSIS OF HIGH DENSITY STORAGE DEVICES M.S. Thesis
Robert John Carden Jun. 1972 100 p refs
(AD-753626) Avail: NTIS CSCL 09/2

With the need for storage of greater volumes of data, new technology has emerged in high density recording of data. A review is made of the conventional magnetic storage devices, including tapes, drums, and discs, and their double density replacements. A detailed analysis of disc storage devices is included. Mass storage units with very high recording densities are discussed. The different approaches taken toward mass storage are presented, followed by an example of each approach. Finally, one of these example systems, a laser mass memory system called UNICON, is analyzed with respect to file organization and I/O routines. Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-18218*# Scientific Translation Service, Santa Barbara, Calif.
SIMPLIFIED 12 GHz LOW NOISE CONVERTER WITH MOUNTED PLANAR CIRCUIT IN THE WAVEGUIDE
Y. Konishi, K. Uenakada, N. Yazawa, N. Hoshino, and T. Takahashi Washington NASA Jan. 1973 12 p refs Transl. into ENGLISH of "Rittai Heimen Kairo Wo Mochiita Kanigata 12 GHz Teizatsuon Konbata", Rept. MW72-86 Denshi Tsushin Gakkai Maikuro-ha Kenkyukai Shiryo, Oct. 1972 5 p
(Contract NASw-2483)
(NASA-TT-F-14656; MW72-86) Avail: NTIS HC $3.00 CSCL 09E

A prototype low-noise converter was tested with a signal frequency of 12 GHz and an intermediate frequency of 420 MHz. The results of a trial manufacture of the prototype are described. Author

N73-18219*# Texas Instruments, Inc., Dallas. Equipment Group.
AIRBORNE ELECTRONICALLY STEERABLE PHASED ARRAY Final Report
Jul. 1972 89 p refs
(Contract NAS8-25847)
(NASA-CR-124041; U1-977580-F) Avail: NTIS HC $6.50 CSCL 09E

The results are presented of the second stage of a program for the design and development of a phased array capable of simultaneous and separate transmission and reception of radio frequency signals at S-band frequencies. The design goals of this stage were the development of three major areas of interest required for the final prototype model. These areas are the construction and testing of the low-weight, full-scale 128-element array of antenna elements, the development of the RF manifold feed system, and the construction and testing of a working module containing diplexer and transmit and receive circuits. Author

N73-18220# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
SEMICONDUCTOR-POWER-AMPLIFIERS IN THE S-BAND UNTIL 20 WATTS WITH EFFICIENCIES NEAR 30 PERCENT
H. Bassenberg, B. Schmidt, and R. Stoiber 1972 73 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-53) Avail: NTIS HC $5.75; DFVLR Porz-Wahn; 24,20 DM

The activities are reported on a semiconductor transmitter in the S-band. The investigations extended to a semiconductor-power-amplifier at 2.30 GHz and output power between 10 and 20 watts with optimum efficiency. The optimum realization is a combination with transistor amplifiers, and varactor frequency doubler. New microwave power transistors give also good results at 2.30 GHz. The amplifiers, realized in microstrip technique, are discussed and the measurement results are presented in diagrams. Author

N73-18221# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
DESIGN AND MECHANISM OF AN AUTOCATHODE
H. Bessing 1972 40 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-73) Avail: NTIS HC $4.25; DFVLR Porz-Wahn: 11,50 DM

The design of a test device for an autocathode is described and a theoretical investigation of the autocathode mechanism is given. The autocathode is located in the center of a discharge chamber with a cylindrical anode in a 100 1-vacuum tank. The ignition of the autocathode requires special means and is explained too. The electron emission mechanism of this cathode was found as a field emission. Finally the electrical field, the electron and ion current density were calculated in the cathode volume for a presupposed discharge current. Performance data are presented in tables and in diagrams. Author

N73-18222# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AN INFRARED PNEUMATIC TRANSDUCER WITH CAPACITIVE DETECTION
Georges Gauffre and Michel Chatanier 1972 11 p refs Presented at 9th Congr. of the Intern. Comm. on Optics (ICO), Santa Monica, Calif., 9-13 Oct. 1972
(ONERA-TP-1150) Avail: NTIS HC $3.00

The infrared transducer developed, called TRIAS, is an integrated instrument particularly designed for field applications in which the radiation heats a gas, thereby deforming a membrane used as a capacitor plate. Analogical network analysis is used to extend performance to its ultimate value, limited by fundamental thermodynamic noise. This very rugged transducer is particularly suitable for use within the 2-200 Hz bandwidth. Author

N73-18223*# Martin Marietta Corp., Denver, Colo.
STUDY OF FEASIBILITY OF SOLID-STATE ELECTRIC SWITCH GEAR FOR AIRCRAFT AND SPACECRAFT Final Report
E. Buchanan and D. Waddington Mar. 1973 154 p refs
(Contract NAS3-15824)
(NASA-CR-121140; MCR-72-327) Avail: NTIS HC $9.75 CSCL 09A

The design of a solid-state circuit breaker that can be interconnected to a second breaker to form a transfer switch is presented. The breaker operates on a nominal 270-V dc circuit and controls power to loads of up to 15 A. Automatic overload trip is provided as a function of excess energy measured through the breaker and/or excess current through the breaker. After an

overload trip, up to nine preprogrammable attempts to reclose may be tried with programmable delays between each attempt. The breaker or switch is remotely controllable. Test data on performance in the laboratory over temperatures from -45 to 100 C are provided. The feasibility of solid-state switch gear has been established. Author

N73-18224*# National Academy of Sciences-National Research Council, Washington, D.C.
INTEGRATED, SINGLE CHANNEL TYPE FET GYRATOR Patent Application
Erwin S. Hochmair, inventor (to NASA) Filed 2 Feb. 1973 19 p Sponsored by NASA
(NASA-Case-MFS-22343-1; US-Patent-Appl-SN-329237) Avail: NTIS HC $3.00 CSCL 09C

A gyrator circuit is reported that consists of two amplifiers in a circular loop, one producing zero phase shift and the other producing 180 degree phase reversal, in a circuit having medium Q composed of all field effect transistors of the same conductivity type. The current source to each gyrator amplifier comprises an amplifier which responds to changes in current, with the amplified signals fed back so as to limit current. The feedback amplifier has a large capacitor connected to bypass high frequency components and to stabilize the output. The design makes possible the fabrication of circuits with transistors of only one conductivity type. NASA

N73-18225*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SYSTEM FOR GENERATING TIMING AND CONTROL SIGNALS Patent Application
Marvin Perlman, William J. Rousey, and Alan Messner, inventors (to NASA) Filed 26 Dec. 1972 40 p
(Contract NAS7-100)
(NASA-Case-NPO-13125-1; US-Patent-Appl-SN-319150) Avail: NTIS HC $4.00 CSCL 09C

A system capable of generating every possible data frame subperiod and delayed subperiod of a data frame of length M clock pulse intervals (CPIs) is reported. The system comprises parallel modulo-m sub i cascades with maximum flexibility to obtain all subperiods and delayed subperiods of M. NASA

N73-18226# Joint Publications Research Service, Arlington, Va.
STUDY OF VOLT-AMPERE CHARACTERISTICS OF AN OPTICALLY CONTROLLED AVALANCHE TRANSISTOR
V. P. Dyakonov and V. A. Tsigankov 26 Feb. 1973 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Gorkiy), v. 14, no. 9, 1971
(JPRS-58321) Avail: NTIS HC $3.00

A demonstration of the possibility of effective optical control of the shape of S-type volt-ampere characteristics of an avalanche transistor is presented. Author

N73-18227# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
ACCEPTANCE TESTS OF THE TYPE SM 215 NO. 180 6017 DIGITAL dc VOLTMETER [ES SA IS DE RECETTE DU VOLTMETRE DIGITAL CONTINUS. E. LABORATORIES TYPE SM 215 NO. 180.6017]
26 Sep. 1972 33 p In FRENCH
(LRBA-PV-11/520/SIE) Avail: NTIS HC $3.75

The digital high precision dc voltmeter type SM 215 is described. The acceptance test procedure is discussed, and results are compared with the specifications. ESRO

N73-18228# National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.
BULLETIN OF THE RADIO AND ELECTRICAL ENGINEERING DIVISION, NATIONAL RESEARCH COUNCIL OF CANADA, VOLUME 22, NO. 1, JANUARY - MARCH 1972
R. J. Densley 1972 26 p refs
(AD-752845) Avail: NTIS CSCL 09/3

Contents: Treeing in cross-linked polyethylene cables; Improved accuracy for waveguide power measurement; Singularities of solutions to partial differential equations; 2.2-cm variable polarization feed; Evaporated nickel films. GRA

N73-18229# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
NON-CONTACTING CAPACITIVE WAVE TRANSDUCERS. PART 1: THE SOLUTION OF THE LAPLACE EQUATION IN A SPACE BOUNDED BY A FLAT AND A SINUSOIDAL SURFACE AND ITS APPLICATION TO THE EVALUATION OF NONCONTACTING CAPACITIVE WAVE MEASUREMENT
C. M. G. Zwarts Sep. 1972 78 p
(AD-752021; DME-MI-836-PT-1; NRC-12854-Pt-1) Avail: NTIS CSCL 09/1

The Laplace equation has been solved to give the potential and electric field distribution between a flat conducting surface at potential V1 and a sinusoidal conducting surface at potential V2. The solution has been used to evaluate the precision with which sinusoidal waves can be measured in flumes and models with transducers using non-contacting capacitive sensing. Dimensionless factors are used throughout the analysis to enhance the usefulness of graphs and formulas. GRA

N73-18230# Harvard Univ., Cambridge, Mass. Cruft Lab.
NEAR ELECTRIC FIELD TANGENTIAL TO A DRIVEN CYLINDRICAL ANTENNA IMMERSED IN A DISSIPATIVE MEDIUM
Larry D. Scott, D. V. Giri, and Stuart A. Long Oct. 1972 18 p refs
(Contract F19628-68-C-0030; AF Proj. 5635)
(AD-753092; AFCRL-72-0567; SR-14) Avail: NTIS CSCL 09/5

A least-squares polynomial-fit representation is obtained for experimentally measured charge distributions on a base-driven monopole antenna immersed in free space and also in a homogeneous dissipative medium. This representation for the charge is then used in evaluating the tangential electric field near the antenna. Author (GRA)

N73-18231# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DESIGN OF A CAPACITOR BATTERY WITH AN ENERGY RESERVE OF 625 kJ FOR PRODUCING POWERFUL MAGNETIC FIELDS
S. M. Fertik, E. G. Taller, V. V. Konotop, V. Ya. Linetskii, V. S. Gladkov, and G. M. Goliushko 25 Aug. 1972 18 p Transl. into ENGLISH from Akad. Nauk SSR, Magnitnye Lovushki (Kiev), 1965 p 137-146
(AD-750535; FTD-MT-24-896-72) Avail: NTIS CSCL 09/1

The article described the design and final construction of a capacitor bank rated 625 kJ and intended to operate at four different charging voltage (50, 100, 200, and 250 kV), with much larger operating life than earlier designs (not less than 200,000 discharges as against 2000-5000) and with low total inductance. The main stages of the development consisted of designing a special capacitor (type KIMS-1) rated 10 microfarads (12.5kJ), and a special system of interconnecting and switching the capacitor bank, consisting of special discharge gaps and various high voltage coaxial cables. Problems involved in stacking the capacitors into columns, mechanical strength and safety during discharge are also discussed. Author (GRA)

N73-18232# General Electric Co., Syracuse, N.Y.
SIMPLIFIED MODELING OF INTEGRATED CIRCUITS FOR RADIATION PERFORMANCE PREDICTION Technical Report, Feb. 1971 - Feb. 1972
J. R. Greenbaum Nov. 1972 275 p
(Contract F29601-71-C-0049)
(AD-753413; AFWL-TR-72-42) Avail: NTIS CSCL 09/1

The report describes a simple method for developing computer models for digital and analog integrated circuits. The models are capable of allowing computer prediction of both normal performance and performance when the devices are exposed to gamma and neutron radiation environments. Device models have been developed for two NAND gates, two flip-flops, one four-bit Shift Register, a Monostable Multivibrator, an AND-OR-INVERTER, and two operational amplifiers. All models are demonstrated to agree with observed laboratory performance for conditions of pulsed gamma radiation of 3 x 10 to the 10th power rads (Si)/Second. Neutron fluence levels of 1.2 x 10 to the 14th power neutrons per square centimeter, as well as

non-radiation conditions. The black box technique is employed for model development. The model descriptions were developed for use with the SCEPTRE circuit analysis program.
Author (GRA)

N73-18233# Stanford Univ., Calif. Microwave Lab.
GEOMETRICAL ACOUSTICS AT MICROWAVE FREQUENCIES Annual Report, 1 Nov. 1971 - 31 Oct. 1972
B. A. Auld and S. Farnow Dec. 1972 21 p refs Sponsored by Navy
(AD-753385; SU-ML-2123) Avail: NTIS CSCL 09/1

The purpose of this investigation is to study focusing and deflection of microwave acoustic bulk wave and surface wave beams in inhomogeneous anisotropic solids and to evaluate potential device application of these effects. Initially, the emphasis was on strictly geometrical effects and on inhomogeneities induced by means of magnetic and electric fields applied to ferromagnetic and semiconducting crystals. The investigation was later expanded to include diffraction effects and optically induced inhomogeneities, using mechanisms such as photoconductivity in piezoelectric media. Author (GRA)

N73-18234# Naval Undersea Center, San Diego, Calif.
ALTERNATE LEAD AND CERAMIC STAVE FREE-FLOODED CYLINDER TRANSDUCER Research and Development Report, Jan. - Jun. 1972
William F. Fender and Jack W. Holloway Oct. 1972 14 p refs
(SF12120116)
(AD-752759; NUC-TP-311) Avail: NTIS CSCL 09/1

A modified free-flooded piezoelectric cylinder transducer was designed, built and tested that provides a source level of 85 db re 1 mu Pa.m/V over a frequency range of 2.4 - 9.6 kHz. Actual dimensions of the transducer are these: outside diameter, 4.5 inches; wall thickness of ceramic, .25 inches; and height of cylinder, 5 inches. Conventional design was modified by replacing half the staves in an all-ceramic cylinder with lead staves. The modified cylinder has a fundamental radial resonance of less than half the frequency of a conventional all-ceramic cylinder of the same size. In addition, the modified cylinder offers a larger bandwidth than does any previous conventional design. Beam patterns are typical of free-flooded ring design and are omnidirectional in the horizontal plane, perpendicular to the cylinder axis, and ellipitical in the vertical plane. Author (GRA)

N73-18235# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SENSE AMPLIFIER OF A SMALL CAPACITY FERRITE CORE MEMORY
P. Morgin 31 Oct. 1972 16 p refs Transl. into ENGLISH from Tehnika (Yugoslavia), v. 26, no. 1, 1971 p 4-8
(AD-752817; FTD-HC-23-0651-72) Avail: NTIS CSCL 09/2

The report shows how the sense amplifier of a ferrite coincident memory and with the capacity of 1,300 bits, may successfully employ a two step amplifier with amplitudinal discrimination and without a transformer. The separation of the useful signal from noise by means of this amplifier may be compared to the process of separation with the amplifier and the transformer with the same number of semiconductive components but in which case the former is cheaper and simpler to produce. GRA

N73-18236# Owens-Illinois, Inc., Toledo, Ohio. Electro-Optical Display Development Dept.
THREE-COLOR PLASMA PANEL DISPLAY DEVICE Quarterly Progress Report, 1 Apr. - 20 Jun. 1972
H. J. Hoehn, R. A. Martel, and J. Schermerhorn Oct. 1972 60 p refs
(Contract DAAB07-70-C-0243)
(AD-752442; ECOM-0243-7; QPR-7) Avail: NTIS CSCL 09/5

The objectives of this program are to design, fabricate, and evaluate a plasma display panel having 3-color capability and to investigate and develop a technique for operating such a device with three levels of intensity. The basic technique of obtaining color is to deposit phosphor on the inside dielectric surface of an otherwise conventional plasma display panel. The panels are then sealed, evacuated, and backfilled with a gas-mixture that emits vacuum-UV energy when ionized. By application of the proper electronic drive signals, the gas is selectively ionized at discrete electrode intersections, exciting the particular phosphor at that cell-site. Phosphors are arranged on the dielectric surface such that there is at least one red-, one blue-, and one green-emitting phosphor within each group of four adjacent cells. About 15 color-panels with 60 total lines-per-inch resolution (3600 sites per square inch) were fabricated during this report period. Several methods of reducing unwanted optical crosstalk between adjacent cells were evaluated. Facilities for the fabrication of large-area color-panels, including a complete new phosphor lab, were installed, checked out, and placed in use. Fabrication of 3-color panels with 512 x 512 total lines at 60 per inch has begun. Author (GRA)

N73-18237# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SURFACE TRANSFER IMPEDANCE OF SUBMINIATURE COAXIAL CABLES
Charles N. McDowell and Melvin J. Bernstein 31 Aug. 1972 18 p refs
(Contract F04701-72-C-0073)
(AD-753678; TR-0073(3220-60)-2; SAMSO-TR-72-276) Avail: NTIS CSCL 09/1

Research was conducted in the areas of fracture mechanics and mechanisms, environmental influences on fatigue, dislocation behavior, alloy preparation, the use of X-ray diffraction in fatigue, and in non-destructive testing. Author (GRA)

N73-18238# Raytheon Co., Waltham, Mass. Research Div.
NONPIEZOELECTRIC SURFACE WAVE CORRELATOR Final Technical Report, 14 Sep. 1971 - 14 Jun. 1972
Melvin G. Holland Griffiss AFB, N. Y. RADC Nov. 1972 96 p refs
(Contract F30602-72-C-0044)
(AD-753674; S-1487; RADC-TR-72-291) Avail: NTIS CSCL 09/1

The program was to study and characterize an acoustic surface wave, multiple-tap, delay line structure using sputtered zinc oxide (ZnO) overlay piezoelectric films on metal interdigital arrays, on a silicon surface. The tasks included investigation of surface acoustic wave generation techniques as well as the study of surface wave propagation on the ZnO/Si surface. The structures were used to prepare a sequence generator and its reciprocal matched filter to experimentally demonstrate the generation and correlation of a biphase sequence. GRA

N73-18870* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FOLDABLE 4.27 METER (14 FOOT) SPACECRAFT ANTENNA
Donald J. Starkey *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 37-46 (For availability see N73-18866 09-31)
CSCL 09E

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-18239# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
STABILIZATION OF NONLINEAR SYSTEMS WITH A DITHER CONTROL
Avraham M. Steinberg and Isaac Kadushin Mar. 1972 30 p refs
(TAE-150) Avail: NTIS HC $3.50

A new approach is taken to analyze stabilization of a general nonlinear system with a dither input. Given the original system with a control, an autonomous relaxed system is constructed. It is shown that if the relaxed system is stable, then the original system with dither control would be stable in the finite time. An algorithm is given for constructing the dither control. The technique used here is general and does not have the limitations of the Dual Input Describing Function technique. Furthermore,

in many cases it is possible to guarantee global contractive stability as well. Two examples are solved in detail using computer simulations for demonstration of the technique. Author

N73-18240# Texas Univ., Austin. Electronics Research Center.
TEXAS BIANNUAL OF ELECTRONICS RESEARCH, NO. 16 Interim Report, 1 Apr. - 30 Sep. 1972
Arwin A. Dougal 15 Nov. 1972 280 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-753700; AFOSR-72-2227TR) Avail: NTIS CSCL 09/3

The report includes recent findings, research investigations, progress reports and future plans in the areas of Solid State Electronics, Information Systems, Plasma and Quantum Electronics, Bio-Medical Electronics and Acoustics and Radio Sciences. Author (GRA)

N73-18241# Defense Documentation Center, Alexandria, Va.
PACKAGED CIRCUITS Report Bibliography, Jun. 1954 - May 1972
Nov. 1972 151 p refs
(AD-752400; DDC-TAS-72-64) Avail: NTIS CSCL 09/5

Selected references cover such topics as development of principles and techniques of integration and packaging of printed circuits, packaging concepts for uncased integrated circuit systems, advanced electronic packaging techniques, packaging a 30 mc amplifier for airborne use and packaged magnetic digital computer assemblies. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-18242*# Rensselaer Polytechnic Inst., Troy, N.Y.
PATH SELECTION SYSTEM SIMULATION AND EVALUATION FOR A MARTIAN ROVING VEHICLE
Stephen Lee Boheim and William C. Prudon Dec. 1972 69 p refs
(Grant NGL-33-018-091)
(NASA-CR-130978; MP-29) Avail: NTIS HC $5.50 CSCL 13F

The simulation and evaluation of proposed path selection systems for an autonomous Martian roving vehicle was developed. The package incorporates a number of realistic features, such as the simulation of random effects due to vehicle bounce and sensor-reading uncertainty, to increase the reliability of the results. Qualitative and quantitative evaluation criteria were established. The performance of three different path selection systems was evaluated to determine the effectiveness of the simulation package, and to form some preliminary conclusions regarding the tradeoffs involved in a path selection system design. Author

N73-18243# National Bureau of Standards, Washington, D.C. Mechanics Div.
RESEARCH AND TESTING FACILITIES OF THE ENGINEERING MECHANICS SECTION, NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
Daniel J. Chwirut Jan. 1973 23 p ref
(NBS-SP-370; LC-72-600273) Avail: SOD $0.55 as C13.10:370

The principal characteristics of the force measuring and generating equipment and related research facilities available in the Engineering Mechanics Section of the National Bureau of Standards are described. Author

N73-18244# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Raumfahrtaerodynamik.
DESIGN AND SYSTEM DESCRIPTION OF THE THIRD TEST SECTION OF THE HYPERSONIC LOW DENSITY FACILITY OF THE DFVLR (AVA) GOETTINGEN
H. Legge 1971 97 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-84) Avail: NTIS HC $7.00; DFVLR Porz-Wahn: 30 DM

Some fundamental design considerations for the third test section of the low density facility of the DFVLR (AVA) at Gottingen are dealt with. The possible nozzle size is discussed for a given pumping capacity. The supersonic free jet is described with regard to the production of high Mach number and low density flow fields. Future use of the facility for the generation of molecular beams is discussed. The entire system of the third test section is described and the limits of operation are estimated for free jet expansions from room temperature conditions. Author

N73-18245# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Gasdynamik.
TEST-FACILITIES OF THE DFVLR IN THE TRANSONIC AND HYPERSONIC SPEED-RANGE AND MAIN ACTIVITIES
W. Lorenz-Meyer 1971 27 p refs Presented at the 36th Semiann. Meeting of the Supersonic Tunnel Assoc., Huntsville, Ala., 7-8 Oct. 1971
(DLR-FB-71-86) Avail: NTIS HC $3.50; DFVLR Porz-Wahn: 8,40 DM

A survey is given over the efforts to re-establish capable wind-tunnel facilities in Germany after World War 2. Some of the transonic and hypersonic tunnels founded by the wind-tunnel program of the government of the Federal Republic of Germany are described in more detail. The main activities in these tunnels like reentry vehicles, slender bodies and free-flight testing are presented. Author

N73-18246# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
TEMPERATURE MEASUREMENTS IN WIND TUNNELS
J. Baete 1972 59 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-72-27) Avail: NTIS HC $5.00; DFVLR PORZ: 17,30 DM

A survey is given on methods used for the measurement of temperature in wind tunnels of the DFVLR Institute for Applied Gas Dynamics by means of electric contact thermometers. It is followed by indications on possible measuring errors and by an estimation of the accuracy. References of special methods on thermometry are mentioned on reports with a detailed description of these problems. Author

N73-18247# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
SNOW ACCUMULATIONS ON AIR CUSHION VEHICLE TRACK SECTIONS
T. R. Ringer and R. D. Price Oct. 1972 47 p refs
(NRC-12939; DME-MD-52) Avail: NTIS HC $4.50

Snow accumulations have been observed on a number of different shaped beams that may be employed for guided air cushion train tracks. At low wind velocities the snowfall accumulation was similar on all horizontal surfaces; however at high wind velocities the beams with a plane upper horizontal surface accumulated much lower quantities of snow. The vertical member of the inverted Tee track acts as a 100% density snow fence for snowfall with a crosswind. Author

N73-18248# Weapons Research Establishment, Salisbury (Australia).
THE DATA ACQUISITION SYSTEM FOR THE WRE S-1 WIND TUNNEL
R. E. Kane Oct. 1972 41 p refs
(WRE-TN-784(WR/D)) Avail: NTIS HC $4.25

The first phase became operational in May 1972 when the system was connected to the S-1 tunnel, a continuous flow subsonic/supersonic tunnel operating in the Mach number range 0.3 to 1.0 and 1.4 to 2.8. The system, based on a PDP15/20 computer, acquires analog and digital data from the tunnel and records them on compatible magnetic tape. It can be used for on-line or off-line reduction and manipulation of the data and for display of raw or processed data. The computer is also used for setting and controlling the attitude of a model and for

accurately positioning a probe in the flow field. An outline of the system design, expected performance and interfacing design is given. Author

N73-18249# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ERA RESEARCH IN JAPAN
Akira Miyahara, Sunao Kawasaki, Yusuke Kubota, Genichi Horikoshi, Hiroshi Ishizuka, Kazuo Huke, Seiji Usami, Kenya Akaishi, and Hussain Mohmoud M. Saad Dec. 1972 35 p refs
(IPPJ-T-11) Avail: NTIS HC $3.75

The assembly of ERA systems has the components of a field emission high intensity electron gun, a single RF cavity or an induction linac as a post accelerator, and a compression system located in a large vacuum chamber. At the preliminary experiment, an electron beam of 1 kA and of 1 MeV will be injected into a static betatron field of 200 gauss, and an electron ring will be compressed to be 10 MeV by a rising magnetic field. The RF acceleration of high intensity charged bunch is also discussed. Author

N73-18250# Advisory Group for Aerospace Research and Development, Paris (France).
AERODYNAMIC TEST SIMULATION: LESSONS FROM THE PAST AND FUTURE PROSPECTS
Julius Lukasiewicz, ed. (Carleton Univ.) Dec. 1972 89 p refs Presented at AIAA 10th Aerospace Sci. Meeting Panel Discussion, San Diego, Calif., 19 Jan. 1972
(AGARD-R-603) Avail: NTIS HC $6.50

Developments in aerodynamic test facilities used by government, university, and industry are discussed. The following topics are reported: (1) assessment of past experience, (2) present status and future prospects of aerodynamic and air breathing propulsion testing in all speed regimes, (3) ground test and flight comparisons, (4) free flight test techniques, and (5) the development of aerodynamic testing. A review of the major West European wind tunnels and a discussion of aerodynamic test facilities in the United States are included in two appendices. Author

N73-18251# Grumman Aerospace Corp., Bethpage, N.Y. Nuclear and Astrophysics.
HIGH SPATIAL RESOLUTION MULTIWIRE PROPORTIONAL CHAMBER SYSTEMS USING ELECTROMAGNETIC DELAY LINE READOUTS
F. R. Swanson, F. J. Kuehne, and A. J. Favale Feb. 1973 11 p refs
(RM-569J) Avail: NTIS HC $3.00

The results of an investigation to develop multiwire proportional chamber systems utilizing electromagnetic delay lines for high resolution cosmic ray experiments are given. The delay line used is a Plexiglas core type, with a delay constant of 7 nsec/mm. The interpolation properties of this readout scheme resulted in a measured spatial resolution of 75 microns (HWHM), using iron-55 X-rays and a wire spacing of 1 mm. Tracking accuracy over a 6 mm region near the center of the chamber was better than tor-7 microns when fitted to a linear spatial dependence combined with a sinusoid of wire-spacing periodicity. Author

N73-18252# Joint Publications Research Service, Arlington, Va.
THE POSSIBILITY OF BUILDING PULSED ELECTRON ACCELERATORS WITH ENERGIES OF 20 TO 50 MeV
G. P. Mkheidze, M. D. Rayzer, M. S. Rabinovich, and A. A. Rukhadze 6 Feb. 1973 9 p refs Transl. into ENGLISH from Kratkiye Soobshch. po Fiz. (Moscow), no. 3, Mar. 1972 p 67-74
(JPRS-58160) Avail: NTIS HC $3.00

A study is reported of the possibility of building pulsed electron accelerators with energies of 20 to 50 MeV. Author

N73-18253# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Freiburg (West Germany). Inst. fuer Angewandte Mathematik und Mechanik.
CONTRIBUTION TO THE THEORY OF THE DFVLR ROCKET STEAM GENERATOR [BEITRAG ZUR THEORIE DES RAKETEN-DAMPFERZEUGERS DER DFVLR]
Wolfgang Koerner and Ernst Adams Jul. 1971 59 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-36) Avail: NTIS HC $5.00; DFVLR, Porz, West Ger. 15,50 DM

The processes and conditions occurring in a steam generator developed for the Europa 1 rocket third stage altitude test chambers were analyzed. The trajectories of the jets of water, the spectrum of droplets, the aerodynamic decay of droplets, and their vaporization in a hot environment were studied. Equations for the analysis of these processes, which yield results on the design and the performance of the generators, were derived from suitable model assumptions. The processes were treated from a general point of view, and the results applied to steam generators at Lampoldshausen. Author (ESRO)

N73-18254# Technische Hochschule, Aachen (West Germany). Stosswellenlab.
INVESTIGATION OF THE SHOCK WAVE INTERACTION IN A DOUBLE SHOCK TUBE [UNTERSUCHUNG DER WECHSELWIRKUNG VON STOSSWELLEN IM DOPPEL-STOSSROHR]
H. Groenig and P. Fiebig Bonn Bundeswehramt 1972 48 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-72-35) Avail: NTIS HC $4.50; Bundeswehramt 25 DM

It is shown that the influence of a plane wall, reflecting plane shock waves, parallel to the initial shock, may be completely eliminated by the collision of equally strong shock waves. This can be done in a shock tube in which two high pressure sections enclose the low pressure section. The diaphragms of both drivers are ruptured simultaneously by means of an exploding wire technique. Thus shock waves of essentially the same strength are produced, and can be observed by a schlieren system in a test section located at the center of the low pressure section. Preliminary results show a good reproducibility of the experiments, which agree within the usual error limits with theory. Author (ESRO)

N73-18255# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
HYPERSONIC AND HYPERTHERMIC DEVICES FOR AERODYNAMICAL INVESTIGATIONS [HYPERSONE EN HYPERTHERMISCHE INSTALLATIES VOOR AERODYNAMISCH ONDERZOEK]
M. E. E. Enthoven 1972 173 p refs In DUTCH; ENGLISH summary
(VTH-170) Avail: NTIS HC $10.75

Various hypersonic flow regimes for hypersonic vehicles are surveyed, as well as parameters and quantities governing the flow field. The aeromechanical, aerophysical, and aerochemical aspects of the flow are reviewed, in order to assess the required simulation characteristics of laboratory facilities. Current hypersonic, hypervelocity, and low-density ground facilities for aerodynamic research are described, including simulation capability, working principle, construction, operational aspects, measuring techniques, and development possibilities. ESRO

N73-18256# Little (Arthur D.), Inc., Cambridge, Mass.
EVALUATION OF AUXILIARY AGENTS AND SYSTEMS FOR AIRCRAFT GROUND FIRE SUPPRESSION, PHASE 1 Final Report, 29 Nov. 1971 - 13 Mar. 1972
S. Atallah, Ashok S. Kalelkar, and John Hagopian Wright-Patterson AFB, Ohio ASD Aug. 1972 90 p refs
(Contract F33657-72-C-0422)
(AD-753069; ADL-74159; ASD-TR-72-75) Avail: NTIS CSCL 13/12

The program was conducted with the ultimate objective of reducing the number and types of auxiliary extinguishing agents and systems used for aircraft ground fire suppression at military airports. This phase was devoted to the definition of auxiliary agent/system requirements and to the review of existing knowledge on the performance of various agents and systems under particular fire and environmental conditions likely to be encountered at military airports. Where knowledge was lacking, a series of environmental and small scale fire tests were conducted, the latter on three mockups simulating fires in an aircraft engine, fuel running along the incline of an aircraft wing and in a ruptured fuel tank containing reticulated foam. Author (GRA)

N73-18257# Office of Naval Research, London (England).
SOME ELECTRONICS AND NUCLEAR LABORATORIES IN POLAND
A. H. Waynick. 1 Nov. 1972 18 p
(AD-752772; ONRL-R 14-72) Avail: NTIS CSCL 14/2

The report covers visits to three Polish Ministry establishments while attending the 17th General assembly of the International Union of Radio Science, Warsaw, Poland, August 21-29, 1972. The places were: the Polish Institute of Telecommunications, Establishment for the Development and Manufacture of Electronic Scientific Apparatus and the Polish Institute of Nuclear Research. Author (GRA)

N73-18258# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
MOLECULAR BEAM METHODS OF EVALUATING HIGH ENERGY SOURCES FOR ADVANCED PROPULSION METHODS Interim Report, 1 Aug. 1971 - 31 Jul. 1972
Erhard W. Rothe Oct. 1972 36 p refs
(Grant AF-AFOSR-1799-69; AF Proj: 9750)
(AD-753133; AFOSR-72-2303TR) Avail: NTIS CSCL 07/4

The report summarizes research on designing an apparatus to obtain high resolution of relative kinetic energy for collision experiments in the electron volt range. Because it is the center-of-mass system that is important in the interpretation of experiments, energy spreads in both the projectiles and the targets are considered. The target particles are in the form of a crossed beam. Basically, the scheme consists of observing only those reaction products that are formed in a short range of primary-beam flight times. Two research areas are summarized. One deals with the measurement of the electron affinity of NO2 and the other concerns the systematic error in beam-gas experiments. GRA

N73-18259# Naval Weapons Lab., Dahlgren, Va.
PROJECTILE LOADER FOR RESEARCH GAS GUN
William H. Holt and Willis Mock, Jr. Jun. 1972 20 p refs
(AD-753008; NWL-TR-2763) Avail: NTIS CSCL 14/2

A new type of projectile loader for a research gas gun has been designed and fabricated. The design is compared with two existing loader designs, the movable breech and the wrap-around breech. Design and fabrication details are presented. The performance of the loader is discussed. Author (GRA)

N73-18260# Physics International Co., San Leandro, Calif.
SNARK ELECTRON BEAM DEVELOPMENT FOR MATERIALS AND STRUCTURES IRRADIATION Final Report, Dec. 1970 - Jan. 1972
Steven Shope, Philip Spence, and Charles Stallings Nov. 1972 112 p refs
(Contract DASA01-71-C-0045)
(AD-752762; PIFR-301; DNA-2932F) Avail: NTIS CSCL 20/7

The report describes development of electron beam irradiation capabilities on the Defense Nuclear Agency (DNA) SNARK facility for use in materials and structures testing. Both large (about 100 square/cm) and small (about 10 square/cm) irradiation areas are discussed. Electron beam generation and control for this work was accomplished by use of external pulsed magnetic guide fields. Details of the beam transport work are given along with descriptions of several pilot material and structural response experiments. The longitudinal guide field approach is shown to be an efficient > or = .75 percent technique for energy extraction (in a useable fashion) from high-current pulsed electron accelerators. Potential applications of this approach to other generators are also discussed. Author (GRA)

N73-18261# California Inst. of Tech., Pasadena.
CRYOGENIC SHOCK TUBE
H. W. Liepmann, J. C. Cummings, and Viviane C. Rupert Oct. 1972 9 p
(Grant AF-AFOSR-2092-71; AF Proj. 9783)
(AD-753134; AFOSR-72-2424TR) Avail: NTIS CSCL 14/2

Two shock tubes have been developed which allow for partial or full immersion of the test sections within a cryogenic bath. One tube is used for study of shock wave interactions with strong density gradients. The other tube is used to obtain very large shock Mach numbers with ideal gas conditions in all flow regions. Author (GRA)

N73-18262# Environmental Health Lab., McClellan AFB, Calif.
NOISE ENVIRONMENTS OF CONTROL TOWERS Final Report
Robert A. Capell Jan. 1972 19 p
(AF Proj. NBF-133)
(AD-752535; EHL-M-72M-1) Avail: NTIS CSCL 13/2

Noise surveys were made at the control towers of two Air Force bases. Measurements of the indoor and outdoor sound pressure levels during aircraft take-offs and other operations were recorded. These data are presented so that an evaluation of the communication environments can be made by using certain operational data from each base. An evaluation of the noise attenuation provided by each tower is also made. Author (GRA)

N73-18263# Defense Documentation Center, Alexandria, Va.
LANDING FIELDS AND RUNWAYS, VOLUME 1 Report Bibliography, Jan. 1969 - Feb. 1972
Oct. 1972 169 p refs
(AD-751400; DDC-TAS-72-59-Vol-1) Avail: NTIS CSCL 01/5

The bibliography contains unclassified references on Landing Fields and Runways. These references deal with design, configuration, construction, pavement evaluation, rapid preparation sites, paints and coatings, composite materials, maintenance and repair of landing fields and runways. Four computer generated indexes are included. Author (GRA)

N73-18874* Texas Univ., Dallas. Southwestern Medical School.
ZERO GRAVITY TISSUE-CULTURE LABORATORY
James E. Cook, P. OB Montgomery, Jr., and Joseph S. Paul *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 81-89 (For availability see N73-18866 09-31)
CSCL 14B

N73-18882* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE LUNAR CART
Glenn C. Miller *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 169-179 (For availability see N73-18866 09-31)
CSCL 13F

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-18264*# Vanderbilt Univ., Nashville, Tenn. Dept. of Mechanical Engineering.
ANALYSIS OF THE FLOW FIELD GENERATED NEAR AN AIRCRAFT ENGINE OPERATING IN REVERSE THRUST M.S. Thesis
Walter Andrew Ledwith, Jr. Aug. 1972 95 p refs
(Grant NGR-43-002-034)
(NASA-CR-121147) Avail: NTIS HC $6.75 CSCL 20D

A computer solution is developed to the exhaust gas reingestion problem for aircraft operating in the reverse thrust mode on a crosswind-free runway. The computer program determines the location of the inlet flow pattern, whether the exhaust efflux lies within the inlet flow pattern or not, and if so, the approximate time before the reversed flow reaches the engine inlet. The program is written so that the user is free to select discrete runway speeds or to study the entire aircraft deceleration process for both the far field and cross-ingestion problems. While developed with STOL applications in mind, the solution is equally applicable to conventional designs. The inlet and reversed jet flow fields involved in the problem are assumed to be noninteracting. The nacelle model used in determining the inlet flow field is generated using an iterative solution to the Neuman problem from potential flow theory while the reversed jet flow field is adapted using an empirical correlation from the literature. Sample results obtained using the program are included. Author

N73-18265*# California Univ., Berkeley. Fluid Mechanics Div.
KINETIC THEORY ANALYSIS OF RAREFIED GAS FLOW THROUGH FINITE LENGTH SLOTS
Pattabiraman Raghuraman Feb. 1972 93 p refs Sponsored in part by ONR
(Contract NAS8-21432; Grant NSF GK-11651)
(NASA-CR-124069; FM-72-1) Avail: NTIS HC $6.75 CSCL 20D

An analytic study is made of the flow a rarefied monatomic gas through a two dimensional slot. The parameters of the problem are the ratios of downstream to upstream pressures, the Knudsen number at the high pressure end (based on slot half width) and the length to slot half width ratio. A moment method of solution is used by assuming a discontinuous distribution function consisting of four Maxwellians split equally in angular space. Numerical solutions are obtained for the resulting equations. The characteristics of the transition regime are portrayed. The solutions in the free molecule limit are systematically lower than the results obtained in that limit by more accurate numerical methods. Author

N73-18266*# Forsyth Dental Center, Boston, Mass. Dept. of Bioengineering.
DONAR: AN INSTRUMENT SYSTEM FOR DIGITIZING ULTRASHORT SONIC WAVE TRAINS
Sidney Lees, F. B. Gerhard, F. E. Barber, and S. P. Cheney 3 Oct. 1972 35 p refs
(Grant NGR-22-027-001)
(NASA-CR-130883) Avail: NTIS HC $3.75 CSCL 20D

A general purpose instrument, DONAR, that can readily treat all applications based on a digital computer was designed and installed. The DONAR can be programmed to run an experiment, record the data in digital form, extract desired information, process the data, and display the new form of the information or plot the data. It can be readily instructed to change the operating conditions to suit the problem in hand. Author

N73-18267*# Lockheed Missiles and Space Co., Huntsville, Ala. Fluid Mechanics Section.
MATHEMATICAL REPRESENTATIONS OF TURBULENT MIXING Final Report
Richard C. Farmer and Beverly Audeh Jan. 1973 85 p refs
(Contract NAS8-28089)
(NASA-CR-124086; LMSC/HREC-D306102; HREC-8059-2) Avail: NTIS HC $6.25 CSCL 20D

A basic description is given of the mathematical tools and models which are presently used to represent turbulent, free shear layers. Recommendations are included for ways in which current modeling techniques can be improved. Author

N73-18268*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
STUDY ON PROPELLANT DYNAMICS DURING DOCKING Final Report, 29 Jun. 1971 - 15 Mar. 1972
G. C. Feng and S. J. Robertson Mar. 1972 121 p refs
(Contract NAS8-25712)
(NASA-CR-124055; HREC-5712-2; LMSC/HREC-D225632) Avail: NTIS HC $8.25 CSCL 20D

The marker-and-cell numerical technique was applied to the study of axisymmetric and two-dimensional flow of liquid in containers under low gravity conditions. The purpose of the study was to provide the capability for numerically simulating liquid propellant motion in partially filled containers during a docking maneuver in orbit. A computer program to provide this capability for axisymmetric and two-dimensional flow was completed and computations were made for a number of hypothetical flow conditions. Author

N73-18269*# Iowa State Univ. of Science and Technology, Ames.
NUMERICAL CALCULATION OF FLOW FIELDS ABOUT RECTANGULAR WINGS OF FINITE THICKNESS IN SUPERSONIC FLOW Ph.D. Thesis
Jerald Milo Vogel 1973 181 p refs
(Grant NGR-16-002-029)
(NASA-CR-130985) Avail: NTIS HC $11.25 CSCL 20D

The calculation of the outer inviscid flow about a rectangular wing moving at supersonic speeds is reported. The inviscid equations of motion governing the flow generated by the wing form a set of hyperbolic differential equations. The flow field about the rectangular wing is separated into three regions consisting of the forebody, the afterbody, and the wing wake. Solutions for the forebody are obtained using conical flow techniques while the afterbody and the wing wake regions are treated as initial value problems. The numerical solutions are compared in the two dimensional regions with known exact solutions. Author

N73-18270*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
CRITICAL TWO PHASE FLOW FOR CRYOGENIC FLUIDS
R. V. Smith, K. R. Randall (Wichita State Univ.), and R. Epp (Wichita State Univ.) Jan. 1973 79 p refs
(NASA Order W-13300)
(NASA-CR-130793; NBS-TN-633) Avail: NTIS MF $0.95; SOD HC $0.70 as C13.46:633 CSCL 20D

A state-of-the-art survey intended to be useful to a designer of equipment involving two-phase flow of cryogenic fluids is presented. It is desirable to assess the probability of critical or choking, flow in such a system and, if possible, estimate the critical flow rate. The literature is surveyed, and the predictive results for several analytical models are evaluated and compared with experimental data. These results are discussed; however, no firm conclusions are reached because, often, the spread of experimental data is equivalent to the predictive results from the models. Finally, computer evaluations are presented for oxygen, hydrogen and helium along with some design recommendation. Author

N73-18271# Bureau of Mines, Pittsburgh, Pa. Pittsburgh Mining and Safety Research Center.
SOLID-LIQUID FLOW IN NONCIRCULAR PIPES
Richard C. Wang and J. J. Seman 1973 36 p refs
(BM-RI-7725; LC-622.06173; TN23.U7) Avail: NTIS HC $4.00 CSCL 20D

Solid-liquid flow in different pipe geometries was investigated. This investigation was conducted by measuring delivered solids concentration and head loss. The delivered solids concentration was measured to study the effect of pipe geometry on the minimum carrying velocity above which solids do not lag behind the fluid. Head loss was measured to study the effect of pipe geometry on the friction loss. A mathematical formula was developed for determination of the minimum carrying velocity. Darcy-Weisbach's equation and Durand's equation were used for comparison of head losses of pipe shapes. Of the different pipe shapes studied, each having the same interior cross-sectional area, the rectangular pipe with the wide side oriented as the base yielded the lowest minimum carrying velocity at high solids concentrations. The minimum head loss at low velocity and high solids concentration also was attained with this pipe. Although the circular section is known to be the best for transporting liquid only, the present study suggested that pipe geometry is a factor in lowering the operating velocity and reducing head loss in solid-liquid flow. Author

N73-18272# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Aachen (West Germany). Inst. fuer Theoretische Gasdynamik.
THE INTERACTION OF INCIDENT SHOCK WAVES WITH PLANE BLUNT BODY FLOW
D. Rues 1972 66 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-68) Avail: NTIS HC $5.50; DFVLR Porz-Wahn: 19,40 DM

The interaction of a nonsteady shock wave with plane blunt body flow is investigated by a time dependent second order difference method which one can get by some modifications of the LAX-WENDROFF-method. As examples, the interaction with the flow around a circular cylinder and with the flow around a parabolic arc profile is calculated. The velocity of the undisturbed flow is free stream Mach 4, whereas the velocity of the nonsteady incident shock wave is V = -5.5. With these values one gets just behind the incident shock wave for the velocity free stream Mach 4.69 and for the pressure ratio (P sub infinity)/P. At the stagnation point there follows a very strong nonsteady pressure rise. The nonsteady influence on the flow is already

decreasing rapidly after the first reflexion of the incident shock wave from the body. Author

N73-18273# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.

THE SOLUTION OF THE BOUNDARY LAYER EQUATIONS OF CHEMICALLY REACTING GASES WITH A HERMITIAN FINITE DIFFERENCE METHOD

Norbert Peters 1972 156 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-58) Avail: NTIS HC $10.00; DFVLR Porz: 40,50 DM

A highly accurate finite difference method for solving the boundary layer equations of the laminar chemically reacting flat plate flow of a binary gas mixture is developed. First the derivatives in flow direction are replaced by second order finite difference relations. The resulting ordinary differential equations are solved with a fourth order Hermitian finite difference scheme. The stability of the finite difference formulation and the convergence of the iteration procedure are discussed. Numerical results are presented for various flow parameters including a nonequilibrium flow along a plate with discontinuously changing catalytic efficiency. The listing of the FORTRAN-program is included. Author

N73-18274# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

THE PREDICTION OF BASE PRESSURE IN SUBSONIC FLOW PAST WEDGES

M. Tanner 1972 58 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-57) Avail: NTIS HC $5.00; DFVLR Porz: 18,60 DM

A theory was developed for predicting the base pressure in subsonic two-dimensional steady base flow. This theory is based on the concept of mass outflow from the dead-air region. Equations connecting the base pressure with the rate of mass outflow from the dead-air region enables the prediction of both quantities. Theoretically predicted base pressures for the incompressible flow past wedges at zero incidence and past a circular cylinder with laminar separation agree well with experimental values. The influence of the Mach number on the base pressure of a simple back step is given by the theory in agreement with experiment. Further, the theory shows that the dimensionless rate of mass outflow from the dead-air region decreases with increasing Mach number. Author

N73-18275# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.

MEAN QUANTITIES OF NOZZLE BEAMS FOR PARALLEL EQUILIBRIUM FLOW AT THE SKIMMER

U. Bossel 1972 64 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-51) Avail: NTIS HC $5.25; DFVLR Porz: 21 DM

The report deals with the ideal as well as the measurable quantities of nozzle beams skimmed from parallel equilibrium gas flows. The detection procedure, total or partial skimmer interference, and scattering have been included in the analysis. Measurements seem to confirm the assumptions. Author

N73-18276# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.

CALCULATION OF PRESSURE DISTRIBUTION OF AEROFOILS IN CASCADES FOR TWO-DIMENSIONAL, INCOMPRESSIBLE FLOW WITH BOUNDARY-LAYER SEPARATION IN THE REGION OF TRAILING-EDGES

W. Geller 1972 121 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-62) Avail: NTIS HC $8.25; DFVLR Porz-Wahn: 34,40 DM

A singularity method for calculating the flow through cascades with boundary layer separation is given. The contours of the blades are replaced by vortex sheets. Source distributions in the region of separation are used for simulating the displacement effect of separated wake. The source distributions are determined by satisfying the condition of constant static pressure on the blade contours in the full region between separation point on the upper and lower surface. The position of separation points is found by boundary layer calculation. As shown by comparison of theoretical and experimental results, calculated pressure distributions and flow deflection angles are generally well agreeing with measured data while the corresponding drag coefficients agree satisfactorily. Author

N73-18277# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelasik.

EXPERIMENTAL INVESTIGATIONS OF THE FLOW AROUND A HARMONICALLY OSCILLATING CIRCULAR CYLINDER

P. Bublitz 1972 140 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-56) Avail: NTIS HC $9.00; DFVLR Porz-Wahn: 44,70 DM

A description of experimental investigations of the flow phenomena around a circular cylinder under two-dimensional flow conditions is presented. The cylinder could be forced to oscillate harmonically and was at rest in the limiting case. The regime of Reynolds numbers reached from the high subcritical to the supercritical. Special interest was given to the influence of the vibration amplitudes. The main purpose of this work was to measure the fluctuating aerodynamic pressures and forces. For data reduction of the partly stochastic phenomena methods and digital procedures of the statistical analysis of vibrations were used. The calculated correlations and power spectra provide a good insight into the rather complicated physical relations on the cylinder in transverse flow. Author

N73-18278# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.

DRAG MEASUREMENTS OF CONES AT ZERO ANGLE OF ATTACK IN NEAR FREE MOLECULAR FLOW

H. Legge 1972 40 p refs

(DLR-FB-72-64) Avail: NTIS HC $4.00; DFVLR Porz-Wahn: 13,80 DM

Cone drag at zero angle of attack (cone half angles of approximately 10, 15 and 45 deg) was studied in the free molecular and near free molecular flow regime. The measurements were carried out in the third test chamber of hypersonic low density facilities. Free molecular cone drag was calculated for radial hypersonic flow, to correct for gradients within the free jet expansions. The drag was measured as function of the background pressure in the vacuum tank. Thereby, it was possible to account for the influences of the background pressure. The cone drag results are compared with experimental and theoretical results of previous authors. Author

N73-18279# National Aerospace Lab., Tokyo (Japan).

EXPERIMENTAL INVESTIGATION OF TWO-DIMENSIONAL CASCADE PERFORMANCE OF THIN AND LOW CAMBERED DOUBLE CIRCULAR ARC BLADE SECTIONS AT TRANSONIC INLET MACH NUMBER RANGE

Hajime Sakaguchi, Hiroshi Kondo, Susumu Takamori, and Keigo Iwashita 1972 134 p refs In JAPANESE; ENGLISH summary

(NAL-TR-300) Avail: NTIS HC $8.75

The cascade performance of double-circular-arc blades with camber angles of 3 deg, 6 deg, and 10 deg at operating conditions typical of compressor tip sections has been investigated at inlet Mach numbers from 0.6 to 1.1 in a small transonic cascade tunnel. The cascade of the blades were tested over an appreciable range of incidence angle range (up to positive stall angle) for various combinations of stagger angles of 50 deg, 55 deg, 50 deg and pitch-chord ratios of 1.0, 0.8, and 0.6. Experiments were made with boundary layer suction from porous side walls at the test section to establish two-dimensional flow in the cascade. Total-pressure and flow-angle measurements were made by traversing a five-hole probe in the outlet flow from the cascade. The effect of inlet Mach numbers on mean total-pressue recoveries, mean total-pressure loss coefficients, and mean turning angles was investigated. Over the range of inlet Mach numbers experimented, the mean total-pressure loss coefficients were low, and mean turning angles did not change greatly around the design incidence angles. The variation of total-pressure loss coefficient and turning angle with incidence angle was also small and continuous through the experimental range of incidence angle. Author

N73-18280# National Aerospace Lab., Amsterdam (Netherlands).
A SEMI-EMPIRICAL MODEL FOR THE DEVELOPMENT OF A ROUND TURBULENT JET IN A CROSS FLOW
H. Snel 12 Jun. 1971 76 p refs
(NLR-TR-71107-U) Avail: NTIS HC $6.00

A semi-empirical model is presented for the calculation of the development of a round turublent jet in a cross-flow. The model divides the jet flow in a development region and a region of fully developed flow, the first region having the length of the potential core. In the developed region, certain similarity assumptions are used and the measured velocity decay along the jet axis is employed as empirical input. An asymptotic solution of the equations for the jet excess velocity tending to zero describes the jet behaviour far downstream. Comparison of the calculations with measurements shows that the proposed model is able to predict the entire jet development in a reasonably accurate way. Author

N73-18281# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNIT FOR MODULATING A LIQUID FLOW RATE BY DEFORMABLE WALLS
Pierre Planques and Michel Marchetti 1972 14 p In FRENCH; ENGLISH summary Presented at the 23d Cong. de la Federation Intern. d'Astronautique, Vienna, 8-15 Oct. 1972
(ONERA-TP-1160) Avail: NTIS HC $3.00

Techniques for determining the dynamic characteristics of a hydraulic duct are described. The transfer function of a duct can be determined experimentally by a sine variation of the flow, obtained either with a piston or with deformable walls. A theoretical study of the deformable walls method is presented. The cases of incompressible flow and one or two dimensional plane flow are investigated. An experimental procedure to check the validity of the calculations is reported. Author

N73-18282*# United Aircraft Corp., East Hartford, Conn. Fluid Systems Components Div.
SYSTEMATIC TWO-DIMENSIONAL CASCADE TESTS. VOLUME 4: CASCADE TEST DATA
T. A. Murrin and W. E. Taylor 15 Mar. 1973 99 p refs
(Contract NAS3-4184)
(NASA-CR-121101; UARL-M931368-6-Vol-4) Avail: NTIS HC $7.00 CSCL 20D

The data pertaining to the performance characteristics of hydrofoils are presented. The hydrofoils are: (1) double circular arc, (2) multiple circular arc, and (3) slotted doubled circular arc. The experimental data are organized into a systematic presentation format and provided with scale factors and reference values for interpretation. The data include local pressure distributions upstream and downstream of the cascade test section, continuous records from flow angle and total pressure surveys, hydrofoil local pressure distributions, and cavitation data. Author

N73-18283# Joint Publications Research Service, Arlington, Va.
WAVE PROBLEMS IN HYDROACOUSTICS, PART 1
Ye. L. Shenderov 5 Feb. 1973 231 p Transl. into ENGLISH of the publ. "Volnovyye Zadachi Gidroakustiki" Leningrad, Sudostroyeniye, 1972 352 p
(JPRS-58146-1-Pt-1) Avail: NTIS HC $13.75

An explanation of the basic methods used in calculations of sonic fields radiated and diffracted by bodies is presented. The reaction of acoustic waves with elastic bodies is analyzed and also the passage of sound through elastic plates and shells. Author

N73-18284# Joint Publications Research Service, Arlington, Va.
WAVE PROBLEMS IN HYDROACOUSTICS, PART 2
Ye. L. Shenderov 5 Feb. 1973 209 p refs Transl. into ENGLISH of the publ. "Volnovyye Zadachi Gidroakustiki" Leningrad, Sudostroyeniye, 1972 352 p
(JPRS-58146-2-Pt-2) Avail: NTIS HC $12.50
For abstract, see N73-18283

N73-18285*# Bell Aerospace Co., Buffalo, N.Y.
A THEORETICAL STUDY OF MIXING DOWNSTREAM OF TRANSVERSE INJECTION INTO A SUPERSONIC BOUNDARY LAYER
A. J. Baker and S. W. Zelazny Dec. 1972 75 p refs
(Contract NAS1-11214)
(NASA-CR-112254) Avail: NTIS HC $5.75 CSCL 20D

A theoretical and analytical study was made of mixing downstream of transverse hydrogen injection, from single and multiple orifices, into a Mach 4 air boundary layer over a flat plate. Numerical solutions to the governing three-dimensional, elliptic boundary layer equations were obtained using a general purpose computer program. Founded upon a finite element solution algorithm. A prototype three-dimensional turbulent transport model was developed using mixing length theory in the wall region and the mass defect concept in the outer region. Excellent agreement between the computed flow field and experimental data for a jet/freestream dynamic pressure ratio of unity was obtained in the centerplane region of the single-jet configuration. Poorer agreement off centerplane suggests an inadequacy of the extrapolated two-dimensional turbulence model. Considerable improvement in off-centerplane computational agreement occured for a multi-jet configuration, using the same turbulent transport model. Author

N73-18286# Army Air Mobility Research and Development Lab., Moffett Field, Calif.
AN EXPERIMENTAL CORRELATION BETWEEN THE FLOW AND MAGNUS CHARACTERISTICS OF A SPINNING OGIVE-NOSE CYLINDER Ph.D. Thesis - Notre Dame Univ.
James M. Martin and Charles W. Ingram (Notre Dame Univ.) 12 Mar. 1973 29 p refs Backup document for AIAA Synoptic scheduled for publication in the AIAA Journal in Jul. 1973
Avail: NTIS HC $3.50

Strain gage measurements, smoke flow photographs, and hot-wire anemometer studies are used to completely describe the Magnus characteristics of a seven-caliber, tangent-ogive nosed cylinder at low speeds. All of the studies were performed in subsonic wind tunnels. The strain gage measurements show that the Magnus force is positive at small angles of attack and negative at high angles of attack. Smoke flow and hot-wire anemometer studies of the lee-side vortex region reveal three flow phenomena. At low angles of attack, the vortices are absorbed into the turbulent boundary layer as spin is added. This produces a hump or distortion in the boundary layer. At medium and high angles of attack, the high energy of the lee-side vortices inhibits their total absorption by the boundary layer, producing asymmetric vortex regions. Author

N73-18287*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHEMICAL NONEQUILIBRIUM EFFECTS ON THE INVISCID FLOW IN THE WINDWARD PLANE OF SYMMETRY OF TWO SIMPLIFIED SHUTTLE CONFIGURATIONS
John A. Lordi (Cornell Aeronautical Lab., Inc.), Robert J. Vidal (Cornell Aeronautical Lab., Inc.), and Charles B. Johnson Washington Mar. 1973 46 p refs Presented at Space Shuttle Aerothermodynamics Technol. Conf., Moffett Field, Calif., Dec. 1971
(NASA-TN-D-7189; L-8477) Avail: NTIS HC $3.00 CSCL 20D

A theoretical study was made to delineate the effects of thermochemical nonequilibrium in the inviscid flow field of a representative space shuttle orbiter configuration. The study was based on experimental pressure data which was used as an input to a stream tube computer program. The pressure data from two configurations are tabulated. Calculations were restricted to the windward plane of symmetry and the calculations covered an altitude range from 200,000 to 250,000 feet at velocities of 16,000 to 24,000 feet per second respectively. Angles of attack of 20 and 40 degrees were included. The calculations show that the nonequilibrium effects are confined largely to the entropy layer expect at the highest altitude, where significant nonequilibrium effects are observed in the entire inviscid flow field. Author

N73-18288*# Techtran Corp., Silver Spring, Md.
ON THE APPLICATION OF THE SPLITTING METHOD FOR NUMERICAL CALCULATION OF HEAT CONDUCTING GAS FLOWS IN CURVILINEAR COORDINATES

N. N. Yanenko, V. D. Frolov, and V. Ye. Neuvazhayev Washington NASA Feb. 1973 13 p refs Transl. into ENGLISH from Izv. Sibirsk. Otd. Akad. Nauk SSSR, Ser. Tekhn. Nauk (Novosibirsk), v. 2, no. 8, 1967 p 74-82
(Contract NASw-2485)
(NASA-TT-F-14658) Avail: NTIS HC $3.00 CSCL 20D

Eulerian, Langrangian and implicit difference methods of describing motion are juxtaposed and the latter is employed to resolve the two-dimensional problem of axially symmetric motion with thermal conductivity in heterogeneous media. Computer results are presented. Author

N73-18289*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE INVISCID ROLLED-UP STRUCTURE OF LIFT GENERATED VORTICES
Vernon J. Rossow Jan. 1973 22 p refs
(NASA-TM-X-62224) Avail: NTIS HC $3.25 CSCL 20D

A simple form is presented of the relationships for the inviscid, fully developed structure of lift-generated vortices behind aircraft wings. The method is then extended to arbitrary span-load distributions by inferring guidelines for the selection of rollup centers for the vortex sheet, along with rules for calculating the fully developed structure of the resulting multiple vortices. These techniques yield realistic estimates of the rolled-up structure of vortices produced by a wider variety of span-load distributions than possible with the original form of the theory. Author

N73-18290*# Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATIONS OF THE ADMISSIBLE OXYGEN FLOW VELOCITY IN STEEL PIPES FROM A SAFETY POINT OF VIEW
W. Wegener Washington NASA 2 Mar. 1973 23 p refs Transl. into ENGLISH from Stahl Eisen (Duesseldorf), v. 84, no. 8, 1964 p 469-475
(Contract NASw-2483)
(NASA-TT-F-14831) Avail: NTIS HC $3.25 CSCL 20D

Investigations concerning maximum permissible safe flow rates for condensed oxygen in steel pipelines were conducted. It was found that solid dirt particles, such as rust, roll scale, and flakes, in the steel pipeline will not ignite as long as practical flow rates which do not cause significant pressure drop are maintained. At flow rates above eight meters per second, restrictions, such as valves, may constitute a danger. The problem is eliminated by using copper tubing instead of steel pipe. Author

N73-18291# Institut Franco-Allemand de Recherches, St. Louis (France).
APPROXIMATE EQUATIONS FOR THE LATERAL BENDING OF A LINING BY AN EXPLOSIVE SLAB [EQUATIONS APPROCHEES DU RELEVEMENT LATERAL PAR UNE PLAQUE EXPLOSIVE]
M. Defourneaux and D. Lursat 22 Jul. 1971 52 p refs In FRENCH; ENGLISH summary
(ISL-19/71) Avail: NTIS HC $4.75

When a liner is laterally driven by a slab of high explosive, under a certain angle, there is a relation between this angle and the areal density of the liner. Two different assumptions concerning the flow behind the detonation front, taking into account its deflection by the liner, were made in order to give this relation an explicit expression. These assumptions, when combined with energy and momentum balances, yield approximate analytic solutions, in good agreement with the results given by a computed integration of the fundamental equations of fluid dynamics. The agreement is particularly good using the second assumption, according to which the flow produced by a plane slab of high explosive, with a lateral confinement, is identical with part of the flow produced by a thicker non-confined slab. Author (ESRO)

N73-18292# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Munich (West Germany).
THE MACH EFFECT IN DENSE MEDIA WITH CYLINDRICAL SYMMETRIC CONFIGURATION AND ITS APPLICATION TO THE ACCELERATION OF MATTER [DER MACH-EFFEKT IN DICHTEN MEDIEN BEI ZYLINDER-SYMMETRISCHER ANORDNUNG UND SEINE ANWENDUNG ZUR BESCHLEUNIGUNG VON MATERIE]
K. Hollenberg and F. Mueller Bonn Bundeswehramt 1972 26 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-72-3) Avail: NTIS HC $3.50; Bundeswehramt 25 DM

In order to obtain Mach reflection in solids, liquids, and reacting materials (explosives), a configuration was used in which the cylindrical sample was coated with an explosive. The detonation was initiated in such a way that it would run parallel to the cylinder axis and annular on the circumference of the sample. The advantage of this arrangement lies in the very simple construction and the small quantity of explosive required. As the shock front within the range of the Mach disk proceeded in the sample with the detonation velocity, it was possible to obtain higher pressures than could be reached with a plane configuration and a comparable quantity of explosive. The constant pressure over the entire area of the Mach disk makes possible the use of this configuration for the acceleration of plane plates. X-ray flash photographs, taken at the time of detonation, show the Mach reflection in water and explosive. Author (ESRO)

N73-18293# Cambridge Univ. (England). Dept. of Engineering.
THE OFF-DESIGN ANALYSIS OF FLOW IN AXIAL COMPRESSORS
H. Daneshyar and M. R. A. Shaalan London Aeron. Res. Council 1972 51 p refs Supersedes ARC-32727
(ARC-CP-1234; ARC-32727) Avail: NTIS HC $4.75; HMSO 80 p; PHI $3.55

The existence and uniqueness of the solutions obtained from the streamline curvature method of calculating flow through turbomachines are examined for several operating points of Rolls-Royce compressors. It is shown that under certain conditions the truncation errors in the numerical solution can become large and hence give rise to the violation of the uniqueness conditions. The computer program may then give wrong answers to the physical problem. The conditions for existence and uniqueness may be violated when the meridional velocities are small (e.g., near stall) or when there are regions of choked flow. Flow for an operating point in the stall region is computed by suitable modifications to minimize the truncation errors and hence to obtain a unique solution. This is compared with the results of the previously reported actuator disk theory and experiment. The effect of variation of losses on the calculation is examined together with the effect of a correction term due to a dissipative body force, which should be included in the momentum equation when losses are introduced. Author (ESRO)

N73-18294# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF A BOUNDARY LAYER IN THE PRESENCE OF A SUBLAYER OF FOREIGN LIQUID WITH HIGH VISCOSITY
V. G. Bardier and A. V. Smolyakov 14 Nov. 1972 15 p refs Transl. into ENGLISH from Sudostr. Morsk. Sooruzheniya (Kharkov), no. 14, 1970 p 33-38
(AF Proj. 7343)
(AD-752696; FTD-MT-24-771-72) Avail: NTIS CSCL 20/4

The authors discuss the problem of the stability of a boundary layer, on a flat plate, consisting of two layers: a highly viscous liquid in direct contiguity to the plate, and an external current of less viscous liquid. Stability of the more viscous current is provided by the small consumption, while stability of the outer current is investigated by the small disturbances method. The authors discuss the maximum value of the Reynolds number. Author (GRA)

N73-18295# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LINEAR STABILITY OF THREE DIMENSIONAL EQUATIONS OF HYDROMECHANICS WITH VISCOSITY AND THERMAL CONJECTIVITY
M. G. Gadzhiev 17 Nov. 1972 14 p refs Transl. into ENGLISH of the publ. "Voprosy Vychislitelnoy Matematiki" Baku, Izd-vo ELM, 1970 p 39-44
(AF Proj. 7343)
(AD-752692; FTD-HT-23-1077-72) Avail: NTIS CSCL 20/4

The report contains a theoretical study concerning the stability

of the steady state of a compressible viscous fluid with respect to small perturbations. Averaged movement corresponds to the case where the entire mass of the fluid moves like a solid at constant velocity, which makes it possible, by means of choice of the system of coordinates, to reduce the problem of a study of the stability of a medium at rest. The perturbations are assumed to be constant with respect to the spatial coordinates. The characteristic equations written out for two and three dimensional perturbations are reduced to the unidimensional case. The supplementary roots obtained in the course thereof correspond to perturbations attenuating in time. Author (GRA)

N73-18296# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN NONLINEAR PROBLEMS OF THE NONSTEADY MOTION OF LIQUIDS AND GASES IN PIPELINES
S. N. Buzinov, Z. T. Galiullin, and N. A. Karpova 20 Oct. 1972 29 p refs Transl. into ENGLISH from Vop. Trans. Prirod. Gaza (USSR), no. 38/46, 1970 p 149-162
(AD-752685; FTD-HT-23-833-72) Avail: NTIS CSCL 20/4

Solutions of a system of nonlinear differential equations in partial derivatives are considered for the nonsteady state movement of fluids in the use of the Leybenzon function in cases where the pressure or outflow in the initial section of the semi infinite tube varies according to a power law. Some amount of fluid is introduced; this is a problem in instantaneous source for the boundary conditions. There is a jump in the outflow, or the outflow varies according to a sine law. Author (GRA)

N73-18297# California Inst. of Tech., Pasadena.
THE STRUCTURE OF TURBULENT LINE VORTICES
P. G. Saffman 13 Oct. 1972 38 p refs
(Grant AF-AFOSR-2092-71; AF Proj. 9783)
(AD-753131; AFOSR-72-2283TR) Avail: NTIS CSCL 20/4

A theory is given to explain the observed dependence on Reynolds number of the decay of turbulent line vortices. The discussion considers first the self-similar vortex, in which all quantities are assumed to depend only on the circulation at infinity, the Reynolds number, and the time from a virtual origin. It is argued that the turbulent line vortex has a triple structure: an outer vortex of given radius, an inner vortex, and a viscous core. The axial velocity in the core, produced by growth of a trailing vortex shown to be Reynolds number dependent.
Author (GRA)

N73-18298# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT Quarterly Report, 1 Jul. - 30 Sep. 1972
30 Sep. 1972 76 p refs
(AD-752027; DME/NAE-1972(3)) Avail: NTIS CSCL 20/4

Contents: The NAE flying spot scanner/analyser; Dynamic modelling of the innovation cycle as applied to fluidics; Current projects of the division of mechanical engineering and the national aeronautical establishment. GRA

N73-18299# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
COMPACT TRANSPIRATION COOLING FREE JET TEST RESULTS AND COMPARISON WITH THEORY
Robb W. Newman Oct. 1972 78 p refs
(Contract N00017-72-C-4401)
(AD-753109; APL-TG-1178) Avail: NTIS CSCL 20/4

A series of free-jet tests were carried out to obtain experimental data for use in evaluating the accuracy of a compact transpiration cooling computer program. Nominal test conditions were Mach 2, 115 psia total pressure, and 500 F total temperature. The test model was a flat plate with partially semicylinder leading edge; nitrogen gas was used as the transpirant. Tests were carried out for a wide range of coolant flow rates and the results correlated with theory. Good agreement was obtained between measured and computed results of plenum pressure variation, porous surface temperatures without transpiration cooling, and solid surface temperatures for all runs. The predicted temperatures for the stagnation line on the porous matrix surface were consistently lower than the measured values. Author (GRA)

N73-18300# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF HEAT EXCHANGE AND DRAG DURING A TURBULENT FLOW OF COMPRESSIBLE GAS
L. M. Zysina-Molozhen and I. N. Soskova 27 Nov. 1972 24 p refs Transl. into ENGLISH from Teplo i Massoperenos, pervoe Vses. Soveshch. (Minsk), v. 1, 1968 p 86-100
(AD-753046; FTD-MT-24-1525-72) Avail: NTIS CSCL 20/4

A study was made of a two layered model of a compressed turbulent boundary layer with heat exchange. A temperature profile was determined from the Crocco integral; for the velocity profile in the turbulent part of the layer a Van-Drist profile was used. The distinguishing feature of the solution is dependence of the dimensionless width of the laminar sub-layer on the temperature factor and the Mach number. Results of the calculations are compared with experiments on friction and heat exchange. GRA

N73-18301# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
COLLISION INTEGRALS FOR THE KNUDSEN NUMBER DEPENDENCE OF THE GROWTH RATE OF DROPLETS IN A SUPERSATURATED VAPOR Final Report, 1 Jul. 1971 - 31 Aug. 1972
G. E. Kelly and J. V. Sengers Dec. 1972 83 p refs Prepared in cooperation Md. Univ., College Park and NBS, Washington, D. C.
(Contract F40600-72-C-0002; AF Proj. 8951)
(AD-753074; AEDC-TR-72-172) Avail: NTIS CSCL 20/4

The technical report is concerned with the rate of change of the liquid droplets once formed in the vapor. In particular the rate of change of mass of liquid droplets surrounded by the pure vapor is considered. The theory to be presented is valid for droplets formed either by homogeneous or heterogeneous nucleation. Author (GRA)

N73-18302# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
COMPUTER PROGRAM FOR CALCULATING THE RESPONSE OF A PIPING NETWORK TO A SINUSOIDAL EXCITATION
W. G. Hill, Jr. Nov. 1972 37 p refs
(AD-752743; RM-555) Avail: NTIS CSCL 13/11

Dynamic behavior plays an important role in the design of pneumatic control lines and propellant feedlines. Dynamic behaviour can be divided into three categories, with each category requiring a different method of treatment. These categories are: (1) quasi-steady flow, with slowly varying quantities; (2) periodic oscillations, important in stability analysis or hydraulic pump ripple problems; and (3) rapid, nonperiodic variations, such as those caused by the opening and closing of valves. Each of these categories can be further divided into cases where piping motion is negligible, and cases where it must be accounted for. This memorandum describes a method and computer program for computing the response of a complex system to a sinusiodal disturbance where piping motion is negligible or needs to be accounted for at only a small number of points. Author (GRA)

N73-18303*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TRANSONIC WIND TUNNEL INVESTIGATIONS TO DETERMINE THE EFFECTS OF NOZZLE GEOMETRY AND JET PLUME ON THE AERODYNAMICS OF A BODY OF REVOLUTION
James H. Henderson and John E. Vaughn Redstone Arsenal, Ala. Army Missile Command Nov. 1972 263 p refs Sponsored in part by Army Missile Command, Redstone Arsenal, Ala.
(Contract NAS8-4016)
(NASA-CR-130967; AD-752896; RD-TR-72-1723; AMC-DC-1015) Avail: NTIS HC $15.25 CSCL 21/8

A transonic wind tunnel test was conducted by the Army Missile Command, Redstone Arsenal, on a base drag research missile model in the Cornell Aeronautical Laboratory (CAL) 8-Foot Transonic Wind Tunnel during June 1972. The test was conducted to investigate the effects of nozzle geometry on jet plume characteristics at high thrust levels and to study the effects of nozzle geometry on base pressure at low thrust levels. Model external and nozzle internal static pressure measurements were obtained on all nozzles. This report presents details of the test

program, an outline of the test procedures and the results of the investigations in plotted form. Author (GRA)

N73-18304# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN APPLICATION OF THE METHOD OF LINES TO THE TRANSONIC AIRFOIL PROBLEM M.S. Thesis
John Richard McCracken Dec. 1971 62 p refs
(AD-753390; GAM/AE/72-7) Avail: NTIS CSCL 20/4

The development and evaluation are presented of a numerical solution to the transonic airfoil problem. The scope is restricted to symmetrical airfoils at zero incidence angle in an inviscid flow field. The small perturbation relationship and the irrotationality condition are selected for the set of governing equations and the set is reduced to a system of ordinary differential equations by the method of lines. Solutions to this system are compared to experimental data on subcritical, critical, and supercritical airfoils and against the exact solutions to the subsonic and supersonic infinite wavy wall. GRA

N73-18305# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.
PRELIMINARY INVESTIGATION OF HIGH-VELOCITY LIQUID IMPACT DAMAGE
Ray Kinslow, Vireshwar Sahai, and John Peddieson, Jr. Dec. 1972 159 p refs
(Contract DAAH01-72-C-0375)
(AD-753381; TTU-ES-72-2) Avail: NTIS CSCL 11/6

The research reported has been directed toward an understanding of the mechanics of rain erosion of materials traveling at very high velocities. An analysis of the motion of raindrops in a hypersonic shock layer is described. A high-speed jet impingement analogy of the impact of liquid drops on solid surfaces is used to analytically determine the cavity profile. The effect of stress waves generated by liquid impact is discussed. It is shown that internal damage and spallation resulting from stress waves is often much greater than the material failure in the impact area itself. Experiments have demonstrated that water-drop impact can be closely simulated by the use of a high-speed water jet. Craters formed in the laboratory by the jet are compared with those of a radome surface after a led test in a rainfield.
Author (GRA)

N73-18306# Army Missile Command, Redstone Arsenal, Ala.
SUPERSONIC LAMINAR FLOW REATTACHMENT AND REDEVELOPMENT BEHIND A TWO DIMENSIONAL REARWARD FACING STEP
Donald J. Spring 31 Oct. 1972 54 p refs
(AD-753358; RD-TR-72-16) Avail: NTIS CSCL 20/4

A theoretical study of the flow recompression, reattachment, and redevelopment associated with a supersonic laminar isoenergetic flow past a back step was made. Based on an integral approach, the governing system of ordinary differential equations for such recompression and redevelopment processes was derived by introducing simplified flow models. The effect of finite initial boundary layer on the mixing process was taken into account. The system of equations for recompression was integrated with the base pressure and the starting location of recompression as parameters. These parameters were then determined through the conditions to be satisfied at the point of reattachment. GRA

N73-18307# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE DYNAMIC RESPONSE OF FLUIDIC CIRCUITS WITH BLOCKED AND ORIFICE TERMINATED LINES
Bradley O. Montgomery Dec. 1971 81 p refs
(AD-753384; GA/ME/72-2) Avail: NTIS CSCL 13/7

The dynamic response of a pneumatic circuit with mean flow was investigated experimentally in the 40-1050 Hz frequency range and the results compared with theory. All cases consisted of a 0.032 in ID line with either a blocked or orifice terminated end line. The orifice sizes used were 0.0135, 0.016 and 0.020 inch ID with a length of 0.062 inches. The line was tested at pressures from 1.5 to 26.0 psig. Comparison of experimental and theoretical results were made with a computer program using Nichols' equations as modified by Krishnaiyer and Lechner, with modification of attenuation for mean turbulent flow using Brown's work. A different orifice impedance model was used with mean turbulent flow than had been used with blocked or mean laminar flow. Author (GRA)

N73-18308# Tel-Aviv Univ. (Israel). Dept. of Mathematical Sciences.
NUMERICAL STABILIZERS AND COMPUTING TIME FOR SECOND ORDER ACCURATE SCHEMES
B. Eilon, D. Gottlieb, and G. Zwas 1972 27 p refs
(Contract F61052-69-C-0041)
(AD-753165; AFOSR-72-0813TR) Avail: NTIS CSCL 20/4

The effects of various numerical stabilizers on the computing time for hyperbolic systems in more than one spatial variable are delineated and tested on a CDC 6600. The results are not only compared on the basis of real computing time, but are also compared at each time step with analytic solutions. It is shown that while the two-step method of Richtmyer gives the minimum computing time, it also has by far the largest errors of all the schemes and is particularly bad near boundaries. An alternate scheme, based on an original extension of Strang's method, is shown to give very rapid covergence and small error, even for the hydrodynamic equations. Author (GRA)

N73-18309# Ultrasystems, Inc., Irvine, Calif.
AXISYMMETRIC TRANSONIC FLOW CALCULATIONS
Bruce S. Masson and Eugene Friedman Oct. 1972 70 p refs
(Contract DAAA21-72-C-0334)
(AD-752898; PA-TR-4271) Avail: NTIS CSCL 19/1

A computer program SONIC 2, was developed to calculate transonic flow about axisymmetric bodies. The code computes the exact, inviscid compressible flow field with or without shock waves, and it uses a body oriented mesh to permit the exact treatment of an arbitrary body shape. The numerical integration employs the method of Godunov to obtain a stable finite difference approximation to the flow equations. Several examples of results of the code are included along with comparisons to wind tunnel data. Author (GRA)

N73-18310# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
A STUDY OF UNSTEADY TRANSONIC FLOWS WITH SHOCK WAVES IN TWO DIMENSIONAL CHANNELS
T. C. Adamson, Jr. (Michigan Univ., Ann Arbor) and G. K. Richey (Michigan Univ., Ann Arbor) Nov. 1972 100 p refs Prepared in cooperation with Michigan Univ., Ann Arbor
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID)
(AD-753221; SQUID-TR-MICH-10-PU) Avail: NTIS CSCL 20/4

A two dimensional unsteady transonic flow of a perfect gas with constant specific heats is considered, with solutions found in the form of perturbations from a uniform, sonic, isentropic flow. Longitudinal viscous stress terms are included so that shock waves can be considered. The case where the characteristic time of a temporal flow disturbance is large compared to the time taken by a sonic disturbance to cross the transonic regime is considered. A similarity solution involving an arbitrary function of time is found and it is shown that this solution corresponds to unsteady channel flows with shock waves, for the case where the walls are in general not stationary. Solutions are presented for thick (shock fills transonic region) and thin (shock tends to a discontinuity) shock waves in unsteady flows, both for decelerating and accelerating channel flows. For the thin shock case, both numerical and asymptotic solutions are given. Author (GRA)

N73-18311# Wisconsin Univ., Madison. Mathematics Research Center.
A LINE SOURCE BENEATH A FREE SURFACE
D. H. Peregrine Aug. 1972 16 p
(Contract DA-ARO(D)-31-124-462)
(AD-753140; MRC-TSR-1248) Avail: NTIS CSCL 20/4

An approximate solution is given for a source in a semi-infinite fluid. It is suggested that the dimensionless source strength has a maximum value. Such a value is found for a source above a horizontal plane. Author (GRA)

N73-18312# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE INERTIAL WAVE FREQUENCY SPECTRUM IN A CYLINDRICALLY CONFINED, INVISCID, INCOMPRESSIBLE TWO COMPONENT LIQUID
Wayman E. Scott Sep. 1972 22 p refs
(DA Proj. 1T0-61102-A-833D)
(AD-752439; BRL-1609) Avail: NTIS CSCL 20/4

A theoretical and experimental study is made of the phenomenon indicated in the title. It is shown that for inertial waves, just as for gravity waves, there are discontinuities in the tangential particle velocities at the interface in a real, two-component liquid, a fact implying the existence of a vortex sheet. For the case where the two liquids completely fill the cylinder, other results are obtained that are analogous to those for gravity waves. In particular, if the liquids are nearly of the same density, there are two sets of frequencies, one set characterizing oscillations of the liquid mass as a whole, the other set characterizing very low frequency oscillations at the interface. For the case in which the two liquids have markedly different densities, there are again two sets of frequencies, one set characterizing oscillations of the inner liquid as though the outer liquid were a solid mass, the other set characterizing oscillations of the outer liquid as though the inner were absent. Author (GRA)

N73-18313# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
STRUCTURE OF THE TURBULENT MIXING LAYER
Garry L. Brown and Anatol Roshko Aug. 1972 6 p
(Contract N00014-67-A-0094-0001)
(AD-753538) Avail: NTIS CSCL 20/4

Results of an experimental study of turbulent mixing between two streams of different density are summarized. The effects of density difference in flows at low Mach number are compared to those due to compressibility effects at high Mach number. The mixing layer at low Mach number is examined for large vortex structures. Author (GRA)

N73-18314# Naval Ship Research and Development Center, Annapolis, Md.
ELECTRO-OPTICAL MEASUREMENTS OF AXIAL DISPERSION IN TURBULENT PIPE FLOW
Robert G. Howard and Ronald C. Tate Jan. 1973 35 p refs
(AD-753801; NSRDC-27-89) Avail: NTIS CSCL 14/2

The objective was to develop a method of measuring axial dispersion of a solute in turbulent pipe flow. This was accomplished by correlating laser light beam absorption with axial dispersion of ink with the hope also of gaining an understanding of the dispersion mechanism. Light beam attenuation by the ink pulse was measured with a photodiode and recorded at two locations. The theoretical density distribution was based on the first order source of axial dispersion, the velocity gradient. Author (GRA)

N73-18315# Naval Postgraduate School, Monterey, Calif.
ADDED MASS OF SUBMERGED OBJECTS OF ARBITRARY SHAPE M.S. Thesis
Ronald Betts Berklite Sep. 1972 82 p refs
(AD-753603) Avail: NTIS CSCL 13/13

Hydrodynamic loads induced on large underwater structures by impulsive motion may be significant design factors. Such loads may be induced by earthquake excitation or may result from acceleration produced while lifting an object in the sea. The theoretical approach to the calculation of these loads is outlined and numerical results are presented for several submerged configurations including a vertical cone, a sphere, and a vertical circular cylinder. Numerical results for these submerged structures are presented in the form of a dimensionless load parameter or added mass coefficient. Results corresponding to a number of different water depths are presented to show the rather sizable effect of the relative water depth on the hydrodynamic force. Author (GRA)

N73-18316# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ATOMIZATION OF LIQUID AND TWO-PHASE FLOWS
M. S. Volynskii 1 Dec. 1972 23 p refs Transl. into ENGLISH from the book "Kinetika i Aerodinamika Protsessov Goreniya Topliv" Moscow, Izd-vo Nauka, 1969 p 60-73
(FTD Proj. T71-04-03)
(AD-753515; FTD-MT-24-1470-72) Avail: NTIS CSCL 21/2

The theory of the spraying of a liquid fuel into a supersonic gaseous stream and of the flow of the dispersed liquid is examined. Systems of equations are presented for 2 phase flow at the initial and main portions of the stream. These equations were solved with a computer and the region of vaporization of the fuel into the supersonic jet was determined. Calculations for streams at Mach 2 are in good agreement with expectations. Author (GRA)

N73-18317# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF INJECTION AND THE CURVATURE OF WALLS ON FLOW SEPARATION
G. I. Maikapar 17 Nov. 1972 17 p Transl. into ENGLISH from Uch. Zap. Tsent. Aerogidrodinamicheskii Inst. (USSR), v. 1, 1970 p 60-68
(FTD Proj. T71-04-03)
(AD-753501; FTD-HT-23-1487-72) Avail: NTIS CSCL 20/4

Examples of Couette flows are used to demonstrate that the critical pressure gradient during the injection of an identical gas is greater in the case of convex solid walls and smaller in the case of concave walls than that for plane solid surfaces. The injection of a gas whose viscosity is lower than that of the main flow reduces the pressure gradient as compared to the injection of an identical gas. The injection of a gas with greater viscosity than that of the main flow increases the critical pressure gradient. GRA

N73-18318# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLUTION OF THE CHAPLYGIN EQUATION BY THE STRAIGHT LINE METHOD
I. Biibosunov and A. Ryskulov 17 Nov. 1972 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 5, 1971 p 56-64
(AD-753557; FTD-HT-23-1238-72) Avail: NTIS CSCL 20/4

The Chaplygin equation is solved in the article by the straight-line method. This solution describes a gas flow around a profile at a high subsonic speed with a local supersonic area limited by a curved shock wave. Author (GRA)

N73-18319# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
FLOW FIELD ON THE LEE SIDE OF A DELTA WING M.S. Thesis
Robert Gene Christophel Dec. 1971 59 p refs
(AD-753389; GAM/AE/72-6) Avail: NTIS CSCL 20/4

A procedure is developed which utilizes the method of characteristics to solve a portion of the flow field on the lee side of a flat plate delta wing with supersonic leading edges at angle of attack but at zero yaw. The procedure requires input conditions of a free stream Mach number, an angle of attack and a sweep angle. The procedure is applied to three sets of input conditions and the resulting data are compared to published experimental and analytical data for the same set of input conditions. The comparisons indicate that the procedure may be useful in predicting the flow field in the pseudo-elliptic region and the position of the internal shock wave on the lee side of the wing. Author (GRA)

N73-18320# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYSIS OF THE FLOW FIELD AROUND A 2-D BODY OF ARBITRARY SHAPE M.S. Thesis
Ellie B. Underwood, Jr. Dec. 1971 87 p refs
(AD-753387; GAM/AE/72-2) Avail: NTIS CSCL 20/4

An analytical study of the two-dimensional viscous, incompressible steady flow over an airfoil of arbitrary shape was made. Theodorsen's method was used to analyze the potential flow around the airfoil, providing edge velocities for the boundary layer equations, which were then solved by the Karman-Pohlhausen method. The resulting boundary layer displacement thickness was then added to the original airfoil shape to obtain a better potential flow solution. Iteration was continued in this manner until the desired accuracy was obtained. A computer program was written to effect this airfoil analysis technique. GRA

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-18321*# Indiana Geological Survey, Bloomington. Coal Section.
APPLICATION OF ERTS-A IMAGERY TO FRACTURE RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY Progress Report, Jul. 1972 - Jan. 1973
Charles E. Wier and Frank J. Wobber, Principal Investigators Jan. 1973 52 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21795)
(E73-10096; NASA-CR-130345) Avail: NTIS HC $4.75 CSCL 08I

The author has identified the following significant results. The most important result to date is the demonstration of the special value of repetitive ERTS-1 multiband coverage for detecting previously unknown fracture lineaments despite the presence of a deep glacial overburden. The Illinois Basin is largely covered with glacial drift and few rock outcrops are present. A contribution to the geological understanding of Illinois and Indiana has been made. Analysis of ERTS-1 imagery has provided useful information to the State of Indiana concerning the surface mined lands. The contrast between healthy vegetation and bare ground as imaged by Band 7 is sharp and substantial detail can be obtained concerning the extent of disturbed lands, associated water bodies, large haul roads, and extent of mined lands revegetation. Preliminary results of analysis suggest a reasonable correlation between image-detected fractures and mine roof fall accidents for a few areas investigated. ERTS-1 applications to surface mining operations appear probable, but further investigations are required. The likelihood of applying ERTS-1 derived fracture data to improve coal mine safety in the entire Illinois Basin is suggested from studies conducted in Indiana.

N73-18322*# Bundesanstalt fuer Bodenforschung, Hannover (West Germany).
MULTIDISCIPLINARY GEOSCIENTIFIC EXPERIMENTS IN CENTRAL EUROPE Progress Report, Oct. 1972 - Jan. 1973
Dieter Bannert, Principal Investigator Jan. 1973 14 p Sponsored by NASA
(E73-10099; NASA-CR-130527) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-18323*# Forest Service, Fairbanks, Alaska.
DEMONSTRATING APPLICABILITY OF SATELLITE DATA TO HYDROLOGY: A BRIEF REPORT ON THE USABILITY OF SATELLITE IMAGES IN HYDROLOGY AND LIMNOLOGY
Kullervo Kuusela, Principal Investigator and Risto Kuittinen [1973] 3 p Sponsored by NASA
(E73-10101; NASA-CR-130529) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-18324*# North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
IDENTIFICATION AND INTERPRETATION OF TECTONIC FEATURES FROM ERTS-1 IMAGERY Progress Report, 1 Dec. 1972 - 31 Jan. 1973
Monem Abdel-Gawad, Principal Investigator Feb. 1973 3 p
(Contract NAS5-21767)
(E73-10275; NASA-CR-130509; SC691-4PR) Avail: NTIS HC $3.00 CSCL 08K

The author has identified the following significant results. Many criteria of active or recent fault movements are observable in the imagery. It was observed that where earthquake epicenter clusters occur, evidence of recent fault movements is generally observed. The opposite was not necessarily true as there are areas where evidence of recent faulting is observed, often along major known faults which are peculiarly devoid of significant seismicity. A tentative conclusion is that the seismicity pattern alone can often be a misleading criteria for potential earthquake hazards. The feasibility of recognizing geomorphic criteria of recent fault movement from ERTS-1 imagery suggests that ERTS imagery should be used to map potentially active faults and utilize this data to develop better criteria for the identification of areas prone to future earthquakes. An apparent correlation was observed between the distribution of mercury deposits in the California Coast Range Province and transverse fault zones trending west-northwest oblique to the trend of the San Andreas system. The significance of this correlation and the full extent of its implication on mercury exploration is under study.

N73-18325*# Montana Univ., Missoula. Dept. of Geology.
APPLICABILITY OF ERTS-1 TO MONTANA GEOLOGY Progress Report, period ending 30 Nov. 1972
Robert M. Weidman, Principal Investigator 19 Feb. 1973 2 p
(Contract NAS5-21826)
(E73-10281; NASA-CR-130564) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Rapid construction of a lineament map for western Montana, drawn as an overlay to a late August band 7 mosaic at a scale of 1:1,000,000 indicates ERTS-1 imagery to be very suitable for quick compilation of topographically expressed lineaments representing scarps and straight canyons. Over 100 such lineaments were detected, ranging in length from 80 down to 5 miles. Most of the major high angle faults of the area are represented, but low angle faults such as the Lewis overthrust are not apparent. Short and medium length lineaments of northeast trend are abundant southeast of a line connecting Missoula and Great Falls. Only about half of the lineaments are shown on the state geologic map, and limited comparisons with more detailed maps suggest that many will merit investigation as possible faults. It is already apparent that ERTS-1 imagery will be useful in construction of a needed tectonic map of Montana.

N73-18326*# Alaska Univ., Fairbanks. Geophysical Inst.
EVALUATION OF FEASIBILITY OF MAPPING SEISMICALLY ACTIVE FAULTS IN ALASKA Progress Report, Jul. 1972 - Jan. 1973
Larry D. Gedney, Principal Investigator and James D. VanWormer 20 Feb. 1973 12 p refs
(Contract NAS5-21833)
(E73-10283; NASA-CR-130566) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. ERTS-1 imagery is proving to be exceptionally useful in delineating structural features in Alaska which have never been recognized on the ground. Previously unmapped features such as seismically active faults and major structural lineaments are especially evident. Among the more significant results of this investigation is the discovery of an active strand of the Denali fault. The new fault has a history of scattered activity and was the scene of a magnitude 4.8 earthquake on October 1, 1972. Of greater significance is the disclosure of a large scale conjugate fracture system north of the Alaska Range. This fracture system appears to result from compressive stress radiating outward from around Mt. McKinley. One member of the system was the scene of a magnitude 6.5 earthquake in 1968. The potential value of ERTS-1 imagery to land use planning is reflected in the fact that this earthquake occurred within 10 km of the site which was proposed for the Rampart Dam, and the fault on which it occurred passes very near the proposed site for the bridge and oil pipeline crossing of the Yukon River.

N73-18327*# Arizona Univ., Tucson. Dept. of Watershed Management.
USE OF EARTH RESOURCES TECHNOLOGICAL SATELLITE (ERTS) DATA IN A NATURAL RESOURCE INVENTORY Progress Report, 1 Dec. 1972 - 31 Jan. 1973
Ernest B. Fish, Principal Investigator 15 Feb. 1973 1 p
(Contract NAS5-21820)
(E73-10290; NASA-CR-130573) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-18328*# Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE

ATMOSPHERE FROM ERTS-1 DATA Progress Report, 7 Jan. 1972 - 6 Mar. 1973
C. B. Ludwig, Principal Investigator and M. Griggs 7 Mar. 1973 7 p
(Contract NAS5-21860)
(E73-10295; NASA-CR-130384; SAI-73-516-LJ; PR-3) Avail: NTIS HC $3.00 CSCL 04A

There are no author-identified significant results in this report.

N73-18329*# Forest Research Inst., Helsinki (Finland).
DEMONSTRATION OF THE APPLICABILITY OF SATELLITE DATA TO FORESTRY Progress Report, Dec. 1972 - Feb. 1973
Kullervo Kuusela, Principal Investigator Feb. 1973 7 p
Sponsored by NASA
(E73-10297; NASA-CR-130553) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. The experiments made with aerial photos and satellite pictures showed that there are distinct correlations between tone values of satellite pictures and the volume of forest growing stock. Field work is regarded as necessary in order to draw more detailed conclusions.

N73-18330*# New York State Museum and Science Service, Albany.
TO EVALUATE ERTS-1 DATA FOR USEFULNESS AS A GEOLOGICAL SENSOR IN THE DIVERSE GEOLOGICAL TERRANES OF NEW YORK STATE Progress Report, period ending 15 Feb. 1973
Y. W. Isachsen, Principal Investigator 15 Feb. 1973 6 p
(Contract NAS5-21764)
(E73-10298; NASA-CR-130554) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-18331*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
UTILIZATION OF ERTS-1 DATA TO MONITOR AND CLASSIFY EUTROPHICATION OF INLAND LAKES Interim Report, Sep. 1972 - Jan. 1973
Phillip E. Chase (Cranbrook Inst. of Sci., Bloomfield Hills, Mich.) and V. Elliott Smith, Principal Investigators Feb. 1973 70 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21810)
(E73-10299; NASA-CR-130555; BSR-4010) Avail: NTIS HC $5.50 CSCL 08H

The author has identified the following significant results. Significant findings are: (1) one acre lakes and one acre islands are detectable; (2) circular lakes of 7.5 acres and greater reach full density; (3) long channels 100 ft wide are detectable; (4) orientation of lakes is independent of scan direction; (5) lake features are observable in enlargements of CCT imagery produced in the Bendix Earth Resources Data Center; and (6) a decision surface water outline map is presented that was produced from ERTS-1 CCT. A water color literature review, baseline water quality data of the test lakes, and a discussion of geometric corrections of the CCT decision water surface outline map are also presented.

N73-18332*# North Carolina State Univ., Raleigh. Dept. of Geosciences.
UTILIZATION OF ERTS-A DATA IN GEOLOGICAL EVALUATION, REGIONAL PLANNING, FOREST MANAGEMENT, AND WATER MANAGEMENT IN NORTH CAROLINA
Charles W. Welby, Principal Investigator 28 Feb. 1973 2 p
(Contract NAS5-21732)
(E73-10300; NASA-CR-130556) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-18333*# Wyoming Univ., Laramie. Remote Sensing Lab.
DISTINGUISHING MAJOR LITHOLOGIC TYPES IN ROCKS OF PRECAMBRIAN AGE IN CENTRAL WYOMING USING MULTILEVEL SENSING, WITH A CHAPTER ON POSSIBLE ECONOMIC SIGNIFICANCE OF IRON FORMATION DISCOVERED BY USE OF AIRCRAFT IMAGES IN THE GRANITE MOUNTAINS OF WYOMING Special Report
Robert S. Houston, Prinicpal Investigator 16 Feb. 1973 34 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21799)
(E73-10301; NASA-CR-130557; ERTS-1-572-3) Avail: NTIS HC $3.75 CSCL 08G

The author has identified the following significant results. Information obtained by remote sensing from three altitude levels: ERTS-1 (565 miles), U-2 (60,000 feet), and C-130 aircraft (15,000 feet) illustrates the possible application of multilevel sensing in mineral exploration. Distinction can be made between rocks of greenstone belts and rocks of granite-granite gneiss areas by using ERTS-1 imagery in portions of the Precambrian of central Wyoming. Study of low altitude color and color infrared photographs of the mafic terrain revealed the presence of metasedimentary rocks with distinct layers that were interpreted as amphibolite by photogeologic techniques. Some of the amphibolite layers were found to be iron formation when examined in the field. To our knowledge this occurrence of iron formation has not been previously reported in the literature.

N73-18334*# Texas A&M Univ., College Station. Remote Sensing Center.
MONITORING THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION Progress Report, 27 Sep. - 27 Nov. 1972
J. W. Rouse, Jr., Principal Investigator 27 Nov. 1972 18 p ref
(Contract NAS5-21857)
(E73-10302; NASA-CR-130385; PR-1) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. The asserted homogeneity of the Great Plains Corridor was established, as evidenced from test site characteristic determinations. First-look visual analysis of ERTS-1 black and white images reveals the ability to locate network test sites. Geological formations associated with major vegetation types are readily apparent on the imagery. Grasslands are readily distinguishable from forested and cropped areas. Under magnification, pastures as small as five to ten acres can be recognized in areas of contrasting vegetation. Bodies of water (rivers, lakes, and large farm ponds) are easily located on bands 6 and 7. Urban areas and major highways are also easily observed and useful as landmarks.

N73-18335*# Texas A&M Research Foundation, College Station. Remote Sensing Center.
MONITORING THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION Progress Report, 28 Nov. 1972 - 27 Jan. 1973
J. W. Rouse, Jr., Principal Investigator 27 Jan. 1973 12 p
(Contract NAS5-21857)
(E73-10303; NASA-CR-130715; PR-2) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Preliminary evaluation of autumnal phase ground truth data suggests that the sampling procedures at the Great Plains Corridor network test sites are adequate to show relatively small temporal changes in above-ground vegetation biomass and vegetation condition. Vegetation changes measured August through December, reflect grazing intensity and environmental conditions at the test sites. Preliminary analysis of black and white imagery suggests that detail in vegetation patterns is much greater than originally anticipated. A first look analysis of single band imagery and digital data at two locations shows that woodland, grassland, and cropland areas are easily delineated. Computer derived grey-scale maps from MSS digital data were shown to be useful in identifying the location of small fields and features of the natural and cultivated lands. Single band imagery and digital data are believed to have important application for synoptic land use mapping and inventory. Initial ratio analysis, using band 5 and 7 data, suggests the applicability in the greenness of a vegetative scene.

N73-18336*# Arizona Univ., Tucson. Dept. of Biological Sciences.
STUDY OF THE MARINE ENVIRONMENT OF THE NORTHERN GULF OF CALIFORNIA Progress Report, period ending 28 Feb. 1973
J. R. Hendrickson, Principal Investigator 28 Feb. 1973 7 p
(Contract NAS5-21777)
(E73-10304; NASA-CR-130716) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-18337*# Alaska Univ., Fairbanks. Inst. of Arctic Biology.
A NEW VEGETATION MAP OF THE WESTERN SEWARD PENINSULA, ALASKA, BASED ON ERTS-1 IMAGERY Interim Scientific Report
James H. Anderson and Albert E. Belon, Principal Investigators 20 Feb. 1973 22 p refs
(Contract NAS5-21833)
(E73-10305; NASA-CR-130717) Avail: NTIS HC $3.25 CSCL 08B

The author has identified the following significant results. A reconstituted, simulated color-infrared ERTS-1 image covering the western Seward Peninsula was prepared and it is used for identifying and mapping vegetation types by direct visual examination. The image, NASA ERTS E-1009-22095, was obtained approximately at 1110 hours, 165 degrees WMT on August 1, 1972. Seven major colors are identified. Four of these are matched with units on existing vegetation maps: bright red - shrub thicket; light gray-red - upland tundra; medium gray-red - coastal coastal wet tundra; gray - alpine barrens. The three colors having no map equivalents are tentatively interpreted as follows: pink - grassland tundra; dark gray-red - burn scars; light orange-red - senescent vegetation. A vegetation map, drawn by tracing on an acetate overlay of the image is presented. Significantly more information is depicted than on existing maps with regard to vegetation types and their areal distribution. Furthermore the preparation of the new map from ERTS-1 imagery required little time relative to conventional methods and extent of areal coverage.

N73-18338*# Alaska Univ., Fairbanks. Inst. of Arctic Biology.
IDENTIFICATION, DEFINITION AND MAPPING OF TERRESTRIAL ECOSYSTEMS IN INTERIOR ALASKA Progress Report, 1 Aug. 1972 - 31 Jan. 1973
J. H. Anderson, Principal Investigator 28 Feb. 1973 26 p refs
(Contract NAS5-21833)
(E73-10306; NASA-CR-130718) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N73-18339*# Alaska Univ., Fairbanks. Geophysical Inst.
COORDINATION AND ESTABLISHMENT OF CENTRALIZED FACILITIES AND SERVICES FOR THE UNIVERSITY OF ALASKA ERTS SURVEY OF THE ALASKAN ENVIRONMENT Progress Report, Jul. 1972 - Jan. 1973
Albert E. Belon, Principal Investigator and John M. Miller 20 Feb. 1973 27 p
(Contract NAS5-21833)
(E73-10307; NASA-CR-130719) Avail: NTIS HC $3.50 CSCL 14B

The author has identified the following significant results. Scene 1072-21173 of the Anaktuvuk Pass region of the Brooks Range, Alaska, was studied from the point of view of a resource survey for purposes of land use planning as part of the effort to develop ERTS data processing and interpretation techniques. Other data sources and surface observations were utilized to produce a resource survey of a remote and undeveloped region of Alaska. Three vegetative types are apparent: moist tundra, low brush, and high brush. Watersheds are easily defined on the multispectral imagery. Features related indirectly to economic minerals are discernible from ERTS-1 imagery supported by ground truth data. These include mountains, outwash plains and alluvial deposits, drainage patterns, lineaments and probable bedding planes. This region falls within present land class categories which are not inconsistent with the imperatives of the resources. These land class categories include native village withdrawals, regional deficiency area, national interest study area for possible inclusion in a national system, public interest areas, utility corridor, and state land selection.

N73-18340*# Corps of Engineers, Waltham, Mass.
ERTS-1 DATA USER INVESTIGATION OF THE USE OF ERTS IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report, 14 Dec. 1972 - 14 Feb. 1973
Saul Cooper and Paul Bock, Principal Investigators 2 Mar. 1973 5 p
(NASA Order S-70256-AG)
(E73-10308; NASA-CR-130726) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-18341*# Wyoming Univ., Laramie. Remote Sensing Lab.
COOPERATIVE PROPOSAL TO STUDY THE GEOLOGY OF A TEST SITE IN THE ICE FREE VALLEYS OF ANTARCTICA Progress Report
Robert S. Houston, Principal Investigator 1 Mar. 1973 7 p refs
(Contract NAS5-21818)
(E73-10309; NASA-CR-130727) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-18342*# Michigan State Univ., East Lansing.
USE OF ERTS DATA FOR A MULTIDISCIPLINARY ANALYSIS OF MICHIGAN RESOURCES Progress Report.
Axel L. Anderson, Wayne Myers, Gene Safir, and S. P. Hiteside, Principal Investigators 20 Feb. 1973 14 p
(Contract NAS5-21834)
(E73-10310; NASA-CR-130728; PR-1) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-18343*# Tennessee Univ., Knoxville. Dept. of Plant and Soil Science.
UTILIZATION OF ERTS DATA TO DETECT PLANT DISEASES AND NUTRIENT DEFICIENCIES, SOIL TYPES AND MOISTURE LEVELS Progress Report
W. L. Parks, J. I. Sewell, J. W. Hilty, and J. C. Rennie, Principal Investigators 2 Mar. 1973 5 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21873)
(E73-10311; NASA-CR-130729; PR-2) Avail: NTIS HC $3.00 CSCL 02D

There are no author-identified significant results in this report.

N73-18344*# Natural Resources Management Corp., Berkeley, Calif. Research and Development Div.
INVESTIGATION OF THE DETECTION AND MONITORING OF FOREST INSECT INFESTATIONS IN THE SIERRA NEVADA MOUNTAINS OF CALIFORNIA Progress Report, 1 Dec. 1972 - 31 Jan. 1973
Ralph C. Hall, Principal Investigator 31 Jan. 1973 6 p
(Contract NAS5-21770)
(E73-10312; NASA-CR-130730) Avail: NTIS HC $3.00 CSCL 06C

The author has identified the following significant results. The detection of insect infestations through the use of ERTS-1 imagery alone is very promising. In the field of features other than insect infestation, it is possible to detect: timber vs. non-timber; timber density in broad categories; lakes, major stream courses, rock outcrops and domes; riparian vegetation, cultivated fields, pasture land, and glaciers.

N73-18345*# Utah Univ., Salt Lake City. Dept. of Geological and Geophysical Sciences.
GEOLOGY OF UTAH AND NEVADA BY ERTS IMAGERY Progress Report
Mead L. Jensen, Principal Investigator 21 Feb. 1973 7 p
(Contract NAS5-21883)
(E73-10313; NASA-CR-130731; PR-2) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Two ancient watercourses have been observed on ERTS-1 imagery. These lie in the Waterpocket Fold area, north of the Marble

Canyon section of the Colorado River, in Arizona and Utah. A third old watercourse of interest is an ancient canyon of the Colorado and is located on image no. 1156-17260. Image no. 1051-17414 contains some very useful information concerning the hydrology, sedimentology, and biology of Great Salt Lake and Bear Lake in Utah. In Great Salt Lake, there is a sharp line between the portion of the lake north of the railroad causeway and that south of the causeway. There is a marked difference in salinity across the causeway, and this is reflected in different algal species. On the same image, sediment plumes in Bear Lake clearly delineate the circulation pattern, and provide excellent indications of bottom contours over much of the area. Image no. 1051-17420 contains part of Great Salt Lake and all of Utah Lake. The latter displays a very interesting surface pattern which is probably due to an algal bloom which has been swirled into a spiral by the circulation of the lake.

N73-18346*# Geological Survey, Menlo Park, Calif.
PRINCIPAL SOURCES AND DISPERSAL PATTERNS OF SUSPENDED PARTICULATE MATTER IN NEARSHORE SURFACE WATERS OF THE NORTHEAST PACIFIC OCEAN AND THE HAWAIIAN ISLANDS Progress Report, 1 Nov. - 31 Dec. 1972
Paul R. Carlson, Principal Investigator 1 Jan. 1973 5 p
(NASA Order S-70243-AG-7)
(E73-10314; NASA-CR-130732) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Numerous geologic features can be discerned on ERTS-1 imagery of the northwestern Olympic Peninsula, Washington, and southern Vancouver Island, British Columbia. A thick homoclinal sequence of north-dipping Tertiary marine strata along the northwestern Olympic Peninsula is readily discernible because of the banded nature of its outcrop. The submarine basalt on which the sequence rests shows as a high, rugged ridge. Within the sedimentary sequence, alternating sandstone and siltstone members 100 m or more thick show in the southeast corner of the image. Broad, folds in this banded sequence and faults that cut it can be detected. One large fault, the Pysht River fault, and a large syncline in sandstone and siltstone east of it show prominently on the image. Numerous lineations on the image of southern Vancouver Island correlate with faults shown on Muller's map. Particularly prominent are the Leech River and San Juan faults along the southernmost part of the island.

N73-18347*# Geological Survey, Washington, D.C.
ANALYSIS STUDY OF MULTISPECTRAL DATA, ERTS-A FROM AN AREA IN WEST PAKISTAN Progress Report, 1 Nov. - 31 Dec. 1972
Robert G. Schmidt, Principal Investigator 1 Jan. 1973 2 p
(NASA Order S-70243-AG)
(E73-10315; NASA-CR-130733) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-18348*# Geological Survey, Arlington, Va.
DYNAMICS OF SUSPENDED SEDIMENT IN LAKE ONTARIO Progress Report, 1 Jul. - 31 Dec. 1972
Edward J. Pluhowski, Principal Investigator 1 Jan. 1973 6 p
(NASA Order S-70243-AG-2)
(E73-10316; NASA-CR-130734) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. The suspended sediment plumes generated by the Welland Canal and the Genesee River are identifiable in most band 5 frames received from ERTS-1. In descending order of value for plume detection in Lake Ontario are bands 4, 6, and 7. Little or no information content relative to plume detection is available in band 7. The Oswego River plume was not visible during low flow periods; however, it was identifiable immediately following storms. Increased suspended sediment loading emanating from storm runoff increases turbidity levels to the point where the plume becomes visible in the ERTS-1 imagery. Despite the fact that it is detectable from high altitude (60,000 feet) photography, the Niagara River plume was not visible in any of the ERTS-1 frames. Numerous examples of shoreline erosion were evident in the December 7, 1972, imagery of western Lake Ontario. Near shore lake circulation patterns are usually apparent whenever turbidity plumes are sensed by the satellite.

N73-18349*# Geological Survey, Washington, D.C.
THERMAL SURVEILLANCE OF VOLCANOES OF THE CASCADE RANGE AND ICELAND UTILIZING ERTS DCP SYSTEMS AND IMAGERY Progress Report, 1 Jul. - 31 Dec. 1972
Jules D. Friedman, Principal Investigator 1 Jan. 1973 10 p
(NASA Order S-70243-AG)
(E73-10317; NASA-CR-130735) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Significant results of the thermal surveillance of volcanoes experiment during 1972 included the design, construction, emplacement, and successful operation at volcanic sites in the Cascade Range, North America and on Surtsey, Iceland, of automated thermistor arrays which transmit ground and fumarole temperatures via the ERTS-1 data communication system to Goddard Space Flight Center. Temperature, radiance, and anomalous heat flow variations are being plotted by a U.S. Geological Survey IBM 360/65 computer program to show daily fluctuations at each of the sites. Results are being compiled in conjunction with NASA and USGS aircraft infrared survey data to provide thermal energy yield estimates during the current repose period of several Cascade Range volcanic systems. ERTS-1 MSS images have provided new information on the extent of structural elements controlling thermal emission at Lassen Volcanic National Park.

N73-18350*# Geological Survey, Lakewood, Colo. Water Resources Div.
DETERMINE THE UTILITY OF ERTS-1 IMAGERY IN THE PREPARATION OF HYDROLOGIC ATLASES OF ARID LAND WATERSHEDS Progress Report, 1 Jul. - 31 Dec. 1972
Lynn M. Shown, Principal Investigator and J. Robert Owen 1 Jan. 1973 6 p
(NASA Order S-70243-AG)
(E73-10318; NASA-CR-130736) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. The 9x9-inch transparencies from the ERTS-1 system seem to have better contrast in vegetation and drainage features than the 70-mm transparencies. This imagery can be magnified about eight times before it becomes excessively grainy. Imagery in band 7 appears to be the best single band product for viewing landform-water complexes. Band 5 best defines vegetation patterns. Multispectral color-additive viewing would appear to improve the separation of vegetation types where the vegetation exhibits moderate to strong infrared reflectance. Multispectral viewing did not appear to improve relief of drainage channel detail. False-color aerial infrared photographs at a scale of 1:120,000 for the Utah test site are excellent quality and can be magnified as much as 15 times without serious loss of contrast or excessive fuzziness. In desert areas with sparse to moderate shrub cover, the contrast between the soil background and the plant cover is so low that texture cannot be seen, even under high magnification. In areas of higher rainfall during the summer it is possible to discriminate coniferous and deciduous trees, grass, and shrub communities and to identify different rangeland treatment practices.

N73-18351*# Bureau of Indian Affairs, Washington, D.C.
TIMBER RESOURCE INFORMATION SYSTEM Progress Report, 1 Jul. - 31 Dec. 1972
Arthur M. Woll, Principal Investigator Feb. 1972 3 p
(NASA Order S-70243-AG-3)
(E73-10319; NASA-CR-130737) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-18352*# Geological Survey, Menlo Park, Calif.
REMOTE SENSING OF PERMAFROST AND GEOLOGIC HAZARDS IN ALASKA Progress Report, 1 Jul. - 31 Dec. 1972
Oscar J. Ferrians, Jr., Principal Investigator 1 Jan. 1973 4 p
(NASA Order S-70243-AG-2)
(E73-10320; NASA-CR-130738) Avail: NTIS HC $3.00 CSCL

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There are no author-identified significant results in this report.

N73-18353*# Geological Survey, Menlo Park, Calif.
IDENTIFICATION OF GEOSTRUCTURES OF CONTINENTAL CRUST PARTICULARLY AS THEY RELATE TO MINERAL RESOURCE EVALUATION Progress Report, 1 Jul. - 31 Dec. 1972
George Gryc, Principal Investigator and Ernest H. Lathram 31 Dec. 1972 5 p
(NASA Order S-70243-AG-1)
(E73-10321; NASA-CR-130739) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Lakes in the Arctic Coastal Plain of Alaska are dominantly elongate, with their long axes parallel and trending about N 9 W. On ERTS-1 imagery, an additional strong east-trending regional lineation, not previously recognized on aerial photographs or in field study, was noted. In addition, the alignment of many small lakes forms a large and a small ellipse superimposed on the regional lineation. Fischer and Lathram find that the trend of this lineation is parallel to the trend of deflections in contours of the magnetic and gravity fields in the area, and parallel to westerly deflections in the northwest ends of northwest-trending folds mapped to the south. These data suggest that heretofore unsuspected structures may be concealed beneath Quaternary mantling sediments in the area of the image. The strata in these folds would be younger than those tapped by the oil wells of the Umiat field to the south, and favorable sandstone facies may occur in the area. The significance of these observations to oil exploration in northern Alaska needs to be evaluated further.

N73-18354*# Eason Oil Co., Oklahoma City, Okla.
AN EVALUATION OF THE SUITABILITY OF ERTS DATA FOR THE PURPOSES OF PETROLEUM EXPLORATION Progress Report, Dec. 1972 - Jan. 1973
Robert J. Collins, Jr., Principal Investigator 7 Mar. 1973 4 p
(Contract NAS5-21735)
(E73-10322; NASA-CR-130740) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-18355*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
EVALUATION AND COMPARISON OF ERTS MEASUREMENTS OF MAJOR CROPS AND SOIL ASSOCIATIONS FOR SELECTED SITES IN THE CENTRAL UNITED STATES Semiannual Progress Report, Jul. - Dec. 1972
Marion F. Baumgardner, Principal Investigator Jan. 1973 39 p
Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21785)
(E73-10323; NASA-CR-130741) Avail: NTIS HC $4.00 CSCL 02C

There are no author-identified significant results in this report.

N73-18356*# Norwegian Water Resources and Electricity Board, Oslo.
HYDROLOGICAL INVESTIGATIONS IN NORWAY Progress Report, 23 Oct. 1972 - 23 Jan. 1973
Helge A. Odegaard and Johnny Skorve, Principal Investigators 5 Feb. 1973 8 p Sponsored by NASA
(E73-10324; NASA-CR-130742) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-18357*# Delaware Univ., Newark. Coll. of Marine Sciences.
DYNAMICS OF PLANKTON POPULATIONS IN UPWELLING AREAS
Karl-Heinz Szekielda, Principal Investigator Feb. 1973 6 p
(Contract NAS5-21784)
(E73-10325; NASA-CR-130780) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-18358*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN; RESOURCES INVENTORY, LAND USE AND POLLUTION Progress Report, 1 Dec. 1972 - 31 Jan. 1973
George J. McMurtry, Principal Investigator 2 Mar. 1973 31 p
(Contract NAS5-23133)
(E73-10327; NASA-CR-130770) Avail: NTIS HC $3.75 CSCL 08H

The author has identified the following significant results. Identification and mapping of three major kinds of coal refuse targets based on spectral signatures in channels four through seven of the ERTS-1 MSS were conducted. Correlation of the placement of the coal refuse targets with an existing map of their location was accomplished. Digital processing of ERTS-1 data permitted identification of stripped areas including ones that are not discernible by visual analysis of ERTS imagery. Combined visual and digital techniques of analyzing ERTS-1 data for geologic formations have been tried on selected areas of Pennsylvania. Mapping of two major agriculture counties to show land forms, drainage patterns, water, and urban areas were made using positive transparencies of MSS data. Two frames of the same central Pennsylvania area were brought into registration by translation and then merged even though the frames were obtained 71 days apart. P.N.F.

N73-18359*# Department of Agriculture, Washington, D.C. Statistical Reporting Service.
CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Dec. 1972 - 19 Feb. 1973
Donald H. VonSteen, Principal Investigator 19 Feb. 1973 12 p
(NASA Order S-70251-AG-3)
(E73-10328; NASA-CR-130771) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-18360*# Geological Survey, Washington, D.C.
CARTOGRAPHIC EVALUATION OF ERTS ORBIT AND ATTITUDE DATA Progress Report, 1 Jul. - 31 Dec. 1972
Robert B. McEwen, Principal Investigator 1 Jan. 1973 9 p
Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(NASA Order S-70243-AG)
(E73-10329; NASA-CR-130772) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Without the required RBV images, increased attention has been directed toward evaluating the geometric quality of MSS images. A line scan anomaly was identified and analyzed. Successive generations of images have been checked for variations in geometric distortion; it has been consistent. Some recent MSS images have about 250 m rms of relative positional accuracy although earlier images were generally over 300 m. Efforts are continuing to isolate systematic errors in MSS images but present results are inconclusive.

N73-18361*# Maine Dept. of Transportation, Augusta.
DETECTION AND MONITORING VEGETATION DAMAGE ASSOCIATED WITH HIGHWAY FACILITIES Progress Report
Ernest G. Stoeckeler, Principal Investigator 1 Mar. 1973 2 p
(Contract NAS5-21724)
(E73-10331; NASA-CR-130774; PR-5) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-18362*# Geological Survey, Phoenix, Ariz.
APPLICATIONS OF ERTS-A DATA COLLECTION SYSTEM (DCS) IN THE ARIZONA REGIONAL ECOLOGICAL TEST SITE (ARETS) Progress Report, 15 Oct. - 15 Dec. 1972
Herbert H. Schumann, Principal Investigator 15 Dec. 1972 3 p
(NASA Order S-70243-AG-7)
(E73-10332; NASA-CR-130782) Avail: NTIS HC $3.00 CSCL 08D

The author has identified the following significant results. Preliminary analysis of DCS data from the USGS Verde River stream flow measuring site indicates the DCS system is furnishing

high quality data more frequently than had been expected. During the 43-day period between Nov. 3, and Dec. 15, 1972, 552 DCS transmissions were received during 193 data passes. The amount of data received far exceeded the single high quality transmission per 12-hour period expected from the DCS system. The digital-parallel ERTS-1 data has furnished sufficient to accurately compute mean daily gage heights. These in turn, are used to compute average daily streamflow rates during periods of stable or slowly changing flow conditions. The digital-parallel data has also furnished useful information during peak flow periods. However, the serial-digital DCS capability, currently under development for transmitting streamflow data, should provide data of greater utility for determining times of flood peaks.

N73-18363*# Geological Survey, Phoenix, Ariz.
APPLICATIONS OF ERTS-A DATA COLLECTION SYSTEM (DCS) IN THE ARIZONA REGIONAL ECOLOGICAL TEST SITE (ARETS) Progress Report, 15 Aug. - 15 Oct. 1972
Herbert H. Schumann, Principal Investigator 15 Oct. 1972 3 p
(NASA Order S-70243-AG-7)
(E73-10333; NASA-CR-130783) Avail: NTIS HC $3.00 CSCL 08D

There are no author-identified significant results in this report.

N73-18364*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D.
APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Progress Report, 1 Jan. - 28 Feb. 1973
Harvey K. Nelson, Principal Investigator 1 Mar. 1973 3 p
(NASA Order S-70243-AG-4)
(E73-10334; NASA-CR-130784) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-18365*# National Center for Earthquake Research, Menlo Park, Calif.
INVESTIGATION OF PROTOTYPE VOLCANO SURVEILLANCE NETWORK Progress Report, 1 Jul. - 31 Dec. 1972
Jerry P. Eaton, Principal Investigator and Peter L. Ward 1 Jan. 1973 4 p
(NASA Order S-70243-AG-2)
(E73-10337; NASA-CR-130787) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-18366*# Geological Survey, Washington, D.C.
IRON ABSORPTION BAND ANALYSIS FOR THE DISCRIMINATION OF IRON RICH ZONES Progress Report, 1 Jul. - 31 Dec. 1972
Lawrence C. Rowan, Principal Investigator 30 Jan. 1973 12 p
(NASA Order S-70243-AG)
(E73-10338; NASA-CR-130788) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. A lineament study of the Nevada test site is near completion. Two base maps (1:500,000) have been prepared, one of band 7 lineaments and the other of band 5 lineaments. In general, more lineaments and more faults are seen on band 5. About 45% of the lineaments appear to be faults and contacts, the others being predominantly streams, roads, railway tracks, and mountain crests. About 25% of the lineaments are unidentified so far. Special attention is being given to unmapped extensions of faults, groups of unmapped lineaments, and known mineralized areas and alteration zones. Earthquake epicenters recorded from 1869 to 1963 have been plotted on the two base maps. Preliminary examination as yet indicates no basic correlation with the lineaments. Attempts are being made to subtract bands optically, using an I2S viewer, an enlarger, and a data color viewer. Success has been limited so far due to technical difficulties, mainly vignetting and poor light sources, within the machines. Some vegetation and rock type differences, however, have been discerned.

N73-18367*# Alaska Univ., Fairbanks. Geophysical Inst.
ANALYSIS OF PHOTOMETRIC DATA OBTAINED ON THE 1969 NASA AIRBORNE AURORAL EXPEDITION Final Report, 1 May 1971 - 31 Dec. 1972
Gerald J. Romick 31 Dec. 1972 11 p refs
(Grant NGR-02-001-082)
(NASA-CR-130916) Avail: NTIS HC $3.00 CSCL 04A

The analysis of the 1969 airborne expedition data is centered around two main topics: dayside auroral characteristics and hydroxial airglow variations. Some of the conclusions drawn from the analysis include the following: (1) The midday sector of the auroral oval is bound on the equatorward side by a region of greater than or = to 3 keV electrons. (2) The dayside oval is associated with the cusp region in the magnetosphere which has particle energies usually less than or = to 1 keV and lambda 6300 (OI)/lambda 4278 N2(+) ratios > 10. (3) Discrete earth-sun aligned auroras appear in the polar cap just poleward of the oval superimposed on a < 1 keV particle energy background. (4) The discrete earth-sun aligned auroras seen in the open field line region on the dayside have a similar appearance to some rayed auroras seen on the nightside both in terms of charactertistic particle energy spectra as well as visual appearance. (5) Airglow OH measurements show no appreciable change with latitude or longitude but do show diurnal changes. Two types of enhancements are observed: one associated with visible aurora, and the other uncorrelated with visible aurora. Author

N73-18368*# Texas Univ., El Paso.
PLAGIOCLASE MINERALOGY OF OLIVINE ALKALINE BASALT Final Report
Jerry M. Hoffer 10 Jan. 1973 69 p refs
(Grant NGR-44-012-147)
(NASA-CR-130918) Avail: NTIS HC $5.50 CSCL 08G

A geological and mineralogical study of the Potrillo volcanics is reported. The investigation consisted first of field mapping to establish and identify the different rock types and volcanic features in order to determine the geological history. Next, samples were collected and analyzed petrographically to determine suitable rocks from the various stratigraphic units for study of plagioclase. Samples selected for further study were crushed and the plagioclase extracted for the determination of composition and structural state. These results were then related to the petrology and crystallization of the basalt. Author

N73-18369*# SCI Electronics, Inc., Huntsville, Ala.
A STUDY OF METHODS FOR LOWERING AERIAL ENVIRONMENTAL SURVEY COST
James R. Stansberry Jan. 1973 116 p
(Contract NAS8-29074)
(NASA-CR-124107) Avail: NTIS HC $8.00 CSCL 08B

The results are presented of a study of methods for lowering the cost of environmental aerial surveys. A wide range of low cost techniques were investigated for possible application to current pressing urban and rural problems. The objective of the study is to establish a definition of the technical problems associated with conducting aerial surveys using various low cost techniques, to conduct a survey of equipment which may be used in low cost systems, and to establish preliminary estimates of cost. A set of candidate systems were selected and described for the environmental survey tasks. Author

N73-18370*# Martin Marietta Corp., Denver, Colo.
APPLICATION OF REMOTE SENSOR DATA TO GEOLOGIC ANALYSIS OF THE BONANZA TEST SITE, COLORADO Semiannual Progress Report, 1 Apr. - 30 Sep. 1972
Keenan Lee, comp. Dec. 1972 37 p refs Prepared in cooperation with Colo. School of Mines, Golden
(Grant NGL-06-001-015)
(NASA-CR-130822; Rept-72-7) Avail: NTIS HC $4.00 CSCL 08G

A variety of remote sensor data has aided geologic mapping in central Colorado. This report summarizes the application of sensor data to both regional and local geologic mapping and presents some conclusions on the practical use of remote sensing for solving geologic mapping problems. It is emphasized that this study was not conducted primarily to test or evaluate remote sensing systems or data, but, rather, to apply sensor data as an accessory tool for geologic mapping. The remote sensor data used were acquired by the NASA Earth Observations Aircraft Program. Conclusions reached on the utility of the various sensor data and interpretation techniques for geologic mapping were by-products of attempts to use them. Author

N73-18371# Michigan Univ., Ann Arbor. Infrared and Optics Div.
DESIGN OF A STUDY TO EVALUATE BENEFITS AND COST OF DATA FROM THE FIRST EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS-A) Final Report
G. J. Zissis, K. P. Heiss (Mathematica, Inc.), and R. A. Summers (System Planning Corp.) Jul. 1972 255 p refs Prepared in cooperation with Mathematica, Inc. and System Planning Corp.
(Contract USGS-14-08-0001-13221)
(Rept-11215-1-F) Avail: NTIS HC $14.75

Operational systems for information gathering and analysis based on the technological capability being developed under the ERTS-A experiment by the National Aeronautics and Space Administration will have a wide range of economic, environmental, social, and educational benefits, both in the United States and world-wide. Evaluation of benefits and costs of space-acquired data will provide valuable information needed for evaluating future operational systems and guiding future research and development activities. The recommended methodology uses both case studies of individual applications and broad area analyses of related groups of applications. Analysis and presentation of results is facilitated by the use of matrix presentations relating many of the input and output variables involved in the study. Three case studies are described to illustrate some of the features of the methodology developed in the report. These case studies are concerned with land use management, exploration for copper, and nautical charting of doubtful shoals. Author

N73-18372# Joint Publications Research Service, Arlington, Va.
ENVIRONMENTAL RESEARCH BY MEANS OF MANNED SPACE STATIONS, PART 1
K. Ya. Kondratyev 24 Jan. 1973 256 p refs Transl. into ENGLISH of the book "Issledovaniya Prirodnoy Sredy s Pilotiruyemykh Orbitalnykh Stantsiy" Leningrad, 1972
(JPRS-58055-1-Pt-1) Avail: NTIS HC $15.00

A report, containing an analysis of visual observation data gathered by Soviet manned spacecraft, a discussion of problems concerning photography methods and photointerpretation from space, and an analysis of the potential uses of space spectrophotometry methods for studying the earth environment and natural resources, is presented. For individual titles, see N73-18373 through N73-18375.

N73-18373 Joint Publications Research Service, Arlington, Va.
PART 1: VISUAL OBSERVATIONS OF THE EARTH AND CIRCUMTERRESTRIAL SPACE FROM MANNED ORBITING SPACE STATIONS
G. T. Beregovoy, A. A. Buznikov, O. B. Vasilyev, K. Ya. Kondratyev, A. G. Nikolayev, V. I. Sevastyanov, O. I. Smoktiy, and Ye. V. Khrunov *In its* Environ. Res. by Means of Manned Space Stations, Pt. 1 24 Jan. 1973 p 4-67 refs (For availability see N73-18372 09-13)

The results of visual observations of the atmosphere in the vicinity of the earth's day, twilight and night horizons, as well as land, sea and ocean surfaces, carried out during the Soyuz series manned missions and the Salyut station are reported. A comparison is made with the prior visual observations from the Vostok-6, Voskhod-1, Gemini-3 and Gemini-4 spacecraft. First observations of mesosphere (luminous) clouds from the Soyuz-9 spacecraft are described. The basic features of the psychophysiological characteristics of cosmonaut vision are discussed. The results of observations and investigations of luminous particles appearing during the initial phase of a spacecraft flight are presented. Principal attention is focused on analysis and interpretation of characteristic data obtained by cosmonauts during visual observations of the atmosphere close to the night and twilight horizons. Some results of visual weather observations made by cosmonauts during the Soyuz series missions are also presented. During the Soyuz-4 and Soyuz-5 missions visual observations of the atmosphere near the twilight horizon were combined with spectrophotometry of the twilight halo. This made it possible objectively to evaluate the results of cosmonaut colorimetric visual observations. A similar combination of visual observations with spectrophotometry of various types of topography and underlying surfaces was conducted on the Soyuz-7 and Soyuz-9 missions. Author

N73-18374 Joint Publications Research Service, Arlington, Va.
PHOTOGRAPHING THE EARTH FROM SPACE, PART 2
G. T. Beregovoy, B. V. Vinogradov, G. B. Gonin, O. N. Lebedev, and V. P. Stetsyura *In its* Environ. Res. by Means of Manned Space Stations, Pt. 1 24 Jan. 1973 p 68-186 refs (For availability see N73-18372 09-13)

Technical and methodological procedures developed for interpreting space photographs of the earth's surface are discussed. The procedures were developed for the purpose of solving scientific and practical problems relating to natural resource conservation. E.H.W.

N73-18375 Joint Publications Research Service, Arlington, Va.
SPECTROPHOTOMETRIC INVESTIGATIONS OF THE EARTH FROM MANNED ORBITING SPACE STATIONS, PART 3
A. A. Buznikov, O. B. Vasilyev, V. N. Volkov, K. Ya. Kondratyev, V. I. Sevastyanov, O. I. Smoktiy, and Ye. V. Khrunov *In its* Environ. Res. by Means of Manned Space Stations, Pt. 1 24 Jan. 1973 p 187-252 refs (For availability see N73-18372 09-13)

Basic results of measurements of spectral luminances of various types of underlying surfaces, and the atmosphere, taken from space are reported. A comparison was made of satellite spectral data and analogous data obtained simultaneously in the subsatellite zone from a research aircraft. A transfer function theory was constructed to reduce satellite spectral data on the earth's luminance to the level of the underlying surface. It was demonstrated that a sufficiently fine differentiation of natural features, on the basis of their spectra as obtained from space, is possible from an aggregate of spectral data on reflectivity and a complex of other optical parameters underlying the surfaces. Author

N73-18376*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AGRICULTURAL AND FOREST RESOURCE SURVEYS FROM SPACE
Roger M. Hoffer [1973] 13 p refs Presented at 23d Intern. Astronaut. Congr., Vienna, 8-15 Oct. 1972
(Grant NGL-15-005-112)
(NASA-CR-130798; LARS-100972) Avail: NTIS HC $3.00 CSCL 02C

An overview is presented on the use of spaceborne remote sensors as aid to agriculture and forestry for soil mapping, crop yield predictions, acreage determinations, damage assessment, and numerous other benefits. Some results obtained by ERTS 1 are discussed in terms of the significance of information derived and the potential use of these data for better management of our natural resources. D.L.G.

N73-18377*# Translation Consultants, Ltd., Arlington, Va.
SATELLITES AND THE PROBLEM OF THE EARTH'S NATURAL RESOURCES
K. Ya. Kondratyev Washington NASA 1973 52 p refs Transl. into ENGLISH of the book "Sputniki i Problema Prirodnykh Resursov Zemli" Moscow, Znaniye Press, 1971 p 3-46
(Contract NASw-2038)
(NASA-TT-F-739) Avail: NTIS HC $3.00 CSCL 08F

One of the most interesting of the problems of modern astronautics, that of the use of artificial earth satellites and spacecraft for meteorological and hydrological research, for prospecting for natural resources on planetary scales, and for making geological, topographic, landscape, and other types of surveys of large areas, is discussed. Author

N73-18378*# Scientific Translation Service, Santa Barbara, Calif.
THEORETICAL STUDY OF THE INTERACTION BETWEEN RADIATIVE TRANSFER AND TURBULENT EXCHANGE IN THE LOWER LAYERS OF THE ATMOSPHERE Ph.D. Thesis - Aix-Marseilles Univ.
Bernard Seguin Washington NASA Jan. 1973 136 p refs Transl. into ENGLISH of the book "Etude Theoret. de l'Interaction Entre le Transfert Radiatif et les Echanges Turbulents dans les Basses Couches de l'Atmosphere" Aix-Marseilles Univ., France, 10 Jun. 1971 100 p
(Contract NASw-2483)
(NASA-TT-F-14518) Avail: NTIS HC $9.00 CSCL 04A

The effect of radiation is considered on turbulent exchanges

in the lower atmosphere. The study is performed within the more general framework of atmosphere-ocean interactions. The radiation transfer is first assumed constant. Then the temperature and humidity profiles are calculated to see whether the hypothesis is valid. A method of determining the radiation flux divergence is given. An analytical technique is developed to rapidly evaluate radiation transfer effects. Author

N73-18379# Deutscher Wetterdienst, Hamburg (West Germany). Meteorlogisches Observatórium.
NOMENCLATURE FOR THE DESCRIPTION OF MEASUREMENTS AND COMPUTATIONS OF RADIATION
F. Kasten and E. Raschke (Ruhr Univ.) Oct. 1972 34 p refs In GERMAN; ENGLISH summary
(BMBW-FB-W-72-30) Avail: NTIS HC $3.75; ZLDI, Munich: 7.15 DM

On the basis of international and national convention, the concepts needed for describing radiation measurements and computations in geophysics are compiled, and unequivocal definitions adapted to practical use are attempted. Author

N73-18380# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Abteilung fuer Weltraumforschung.
THE INFLUENCE OF ATMOSPHERIC GRAVITY WAVES IN THE ELECTRON CONTENT OF THE IONOSPHERE
J. P. Schoedel Oct. 1972 72 p refs In GERMAN; ENGLISH summary
(BMBW-FB-W-72-31) Avail: NTIS HC $5.75; ZLDI Munich: 15.15 DM

The electron content of the ionosphere can be continuously measured by two techniques (Faraday-effect and dispersive Doppler effect) when radiobeacons on geostationary satellites are available. These observations show periodic variations with periods between five minutes and several hours. The phenomenology of the observations is introduced. The wave structure can be represented by a linear perturbation theory. It is proved that the hydrodynamic basic equations should only be applied at altitudes below 600 km. Experimentally the wave structure can be separated by means of a high pass digital filter such that variations with periods less than or equal to 120 minutes are reproduced linearly and without phase shift. Author

N73-18381# Bonn Univ. (West Germany). Physikalisches Inst.
A DETERMINATION OF NEUTRAL GAS NUMBER DENSITIES IN THE LOWER THERMOSPHERE BY MEANS OF A MASS SPECTROMETER WITH HELIUM COOLED ION SOURCE
K. U. Grossmann and D. Offermann Dec. 1972 88 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Bildung und Wiss.
(BMBW-FB-W-72-34) Avail: NTIS HC $6.50; ZLDI, Munich: 18.50 DM

On October 13, 1970, at 0208h CET a sounding rocket was launched from Sardinia (39 N) carrying a mass spectrometer with a cryo ion source. The signals obtained in the height range between 118 km and 288 km were transformed to atmospheric number densities by means of a newly developed mathematical model for the ion source. The measured densities of molecular nitrogen and argon are in good agreement with the results of former measurements. However, the densities of atomic oxygen are considerably higher than in former mass-spectrometric measurements and agree very well with the O-densities of Jacchia's revised static models, 1971. Relatively low O2-densities were obtained. Therefore for instance at 120 km a ratio $n(O)/n(O2) = 3.8$ was found. Besides the main atmospheric gases, the concentrations of the trace constituents CO2 and NO were determined. Author

N73-18382# Institut d'Aeronomie Spatiale de Belgique, Brussels.
CHEMOSPHERIC PROCESSES OF NITRIC OXIDE IN THE MESOSPHERE AND STRATOSPHERE
G. Brasseur and M. Nicolet 1973 55 p refs Submitted for publication
(Aeronomica-Acta-A-113) Avail: NTIS HC $4.75

The behavior of nitrogen oxides in the stratosphere and mesosphere is discussed with the aid of a model which introduces the photodissociation and formation of nitric acid. The profiles of the nitric oxide, nitrogen dioxide, and nitric acid concentrations are sensitive to the values of the eddy diffusion coefficients which are adopted. The evaluation of the various reactions which enter the stratosphere shows the role of the formation of nitric acid which is related to the production of OH radicals in the lower stratosphere. An increase of the water vapor in the stratosphere leads to a decrease of nitric oxide and nitrogen dioxide. Author

N73-18383# Institut d'Aeronomie Spatiale de Belgique, Brussels.
ON THE BEHAVIOR OF NITROGEN OXIDES IN THE STRATOSPHERE
G. Brasseur and S. Cieslik 1972 18 p refs Presented at Symp. on Atmospheric Ozone, Arosa, Switzerland, 21-26 Aug. 1972 and at Climatic Impact Assessment Program (CIAP) Meeting, Gaithersburg, Md., 12-13 Sep. 1972; sponsored by DOT Submitted for publication
(Aeronomica-Acta-A-110) Avail: NTIS HC $3.00

A summary is presented of the relative importance of the principal aeronomic processes determining the vertical distribution of NO-NO2 in the stratosphere. Formation and destruction of nitric oxide are considered with transport processes for steady state conditions. Estimates of the vertical distribution of NOx are made for extreme conditions of the eddy diffusion coefficient. It is pointed out that NO is determined by the values which are adopted for its photodissociation coefficient which is related to the absorption of solar radiation in the Schumann-Runge bands of molecular oxygen. Author

N73-18384# Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE AERONOMIC DISSOCIATION OF NITRIC OXIDE
S. Cieslik and M. Nicolet 1973 35 p refs Submitted for publication
(Aeronomica-Acta-A-112) Avail: NTIS HC $3.75

A detailed study is made of the atmospheric attenuation of the dissociation of nitric oxide in the mesosphere and stratosphere. The nitric oxide dissociation profile depends on the absorption of the discrete Schumann-Runge bands of O2. The major contribution to the dissociation rate of NO is the predissociation of the delta (0-0) and delta (1-0) bands which can reach the stratosphere. Author

N73-18385# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ATMOSPHERIC SOUNDING AND LIDAR ANEMOMETRY
Claude Veret 1972 14 p refs Presented at Intern. Colloq. on the Basis of Launching, Kourou, French Guiana, 22-28 Nov. 1972
(ONERA-TP-1151) Avail: NTIS HC $3.00

The lidar may offer a solution for determining quickly the aerologic data above a launching base prior to a rocket firing. The analysis of the light flux backscattered by suspended particles in the atmosphere, when illuminated by the very intense beam of a pulsed laser, permits the fast and precise measurement of cloud altitude and thickness. The evaluation of this signal between several successive pulses also permits determination of the cloud slant-range rate and atmospheric turbulence. Author

N73-18386# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ION-ACOUSTIC WAVE RESPONSE TO AN IMPULSE DISTURBANCE
H. Ikezi, Y. Kiwamoto, K. E. Lonngren, C. M. Burde, and H. C. S. Hsuan Dec. 1972 20 p refs Submitted for publication Sponsored by NSF
(IPPJ-144) Avail: NTIS HC $3.00

The ion acoustic wave response to an impulse disturbance is experimentally examined for two different exciting mechanisms. The differences and similarities are noted for the double plasma and plate excitation methods. The observed response agrees well with that predicted from a self-similar study of a fluid equation model which includes the effects of Poisson's equation. Author

N73-18387# Bureau of Meteorology, Melbourne (Australia).
A STUDY OF SOME ASPECTS OF THE RADIATION AND HEAT BUDGETS OF THE SOUTHERN HEMISPHERE OCEANS M.S. Thesis - Melbourne Univ.
J. W. Zillman Aug. 1972 576 p refs
(Meteorol-Study-26) Avail: NTIS HC $31.00

The radiant, latent and sensible heat energy transfers across

the sea-air interface are examined within several contexts whose unifying theme is the specification of energy conservation constraints on the circulation of the Southern Hemisphere atmosphere and oceans. The concept of energy budgeting is reviewed and exemplified by formulation of an energy budget equation for ice-free ocean. The determination of the three important interface fluxes is then examined from both theoretical and practical standpoints and the literature on their sampling and Southern Hemisphere climatology surveyed. Author

N73-18388*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
PHOTOLYSIS OF O3 AT 3130A
Romualdas Simonaitis, S. Braslavsky, Julian Heicklen, and M. Nicolet 1 Nov. 1972 11 p refs
(Grants NGL-39-009-003; NSF GA-12385; NSF GA-33446X)
(NASA-CR-130794; PSU-IRL-SCI-411) Avail: NTIS HC $3.00 CSCL 04A

The photolysis of O3 at 3130 A and 25 C has been studied in the presence of a large excess of N2O to react with any O(1D) atoms produced. From the N2 produced, the quantum efficiency for O(1D) production was found to be 0.50 + or - 0.03. Author

N73-18389*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
ATMOSPHERIC EFFECTS ON RADIATION MEASUREMENTS
G. M. Jurica 1973 26 p refs
(Grant NGL-15-005-112)
(NASA-CR-130828; LARS-011573) Avail: NTIS HC $3.50 CSCL 04A

Two essentially distinct regions of the electromagnetic spectrum are discussed: (1) the scattering region in which the radiation energy is provided by the incident solar flux; and (2) the infrared region in which emission by the earth's surface and atmospheric gases supply radiative energy. In each of these spectral regions the atmosphere performs its dual function with respect to a remote sensing measurement of surface properties. The atmosphere acts both as a filter and as a noise generator removing and obscuring sought after information. Nevertheless, with proper application of concepts such as have been considered, it will be possible to remove these unwanted atmospheric effects and to improve identification techniques being developed. Author

N73-18390*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERTICAL DISTRIBUTION OF VIBRATIONAL ENERGY OF MOLECULAR NITROGEN IN A STABLE AURORAL RED ARC AND ITS EFFECT ON IONOSPHERIC ELECTRON DENSITIES
Ph.D. Thesis - Catholic Univ. of Am.
George P. Newton Jan. 1973 161 p refs Submitted for publication
(NASA-TM-X-66194; X-621-73-33) Avail: NTIS HC $10.25 CSCL 04A

Previous solutions of the problem of the distribution of vibrationally excited molecular nitrogen in the thermosphere have either assumed a Boltzmann distribution and considered diffusion as one of the loss processes or solved for the energy level populations and neglected diffusion. Both of the previous approaches are combined by solving the time dependent continuity equations, including the diffusion process, for the first six energy levels of molecular nitrogen for conditions in the thermosphere corresponding to a stable auroral red arc. The primary source of molecular nitrogen excitation was subexcitation, and inelastic collisions between thermal electrons and molecular nitrogen. The reaction rates for this process were calculated from published cross section calculations. The loss processes for vibrational energy were electron and atomic oxygen quenching and vibrational energy exchange. The coupled sets of nonlinear, partial differential equations were solved numerically by employing finite difference equations. Author

N73-18391*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MEAN OZONE DISTRIBUTION FROM SEVERAL SERIES OF ROCKET SOUNDING TO 52 km AT LATITUDES FROM 58 DEG S TO 64 DEG N
Arlin J. Krueger Feb. 1973 17 p refs Submitted for publication
(NASA-TM-X-66192; X-651-73-67) Avail: NTIS HC $3.00 CSCL 04A

The results of 21 rocket flights of Arcas optical ozonesondes were combined to produce estimates of the mean ozone distribution and its variability; these estimates apply to a broad range of latitudes. The flights were launched from sites near the equator to 58 S and to 64 N, in the years from 1965 to 1971. The local-noon mean ozone densities in molecules/cubic centimeter are 7.0 to the 10th power at 50 km, 6.7 x 10 to the 11th power at 40 km, 3.1 x 10 to the 12th power at 30 km, and 3.1 x 10 to the 12th power at 20 km. The range of observed densities is about + or - 30 percent of the mean value at 50 km; + or 40 percent at 40 km; + or - 40 percent at 30 km; and +200 percent, -66 percent at 20 km. The variabilities in this set of observations are much smaller than those indicated by previous measurements. Author

N73-18392*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPOSITE STUDY OF CLOUD, OZONE AND OTHER DATA FROM RECENT SATELLITE EXPERIMENTS
M. S. V. Rao, A. J. Krueger, and C. Prabhakara Feb. 1973 38 p refs Submitted for publication
(NASA-TM-X-66190; X-651-73-57) Avail: NTIS HC $4.00 CSCL 04A

Pictorial data from the Image Dissector Camera System (IDCS) and Temperature-Humidity Infrared Radiometer (THIR) experiments on Nimbus 4 satellite are analyzed along with: (a) global total ozone maps prepared from Infrared Interferometer Spectrometer (IRIS) data and (b) total ozone and its vertical distribution as derived from Backscatter Ultraviolet (BUV) spectrometer data. A close relationship is generally observed between centers of high ozone and vortices in the IDCS and THIR montages. This is also confirmed by low centers in the 200 mb Northern Hemisphere charts. The vertical distribution of ozone indicates that the enhancement in ozone in these cases occurs in the lower stratosphere (and possibly to a minor extent in the troposphere) rather than in the upper stratosphere and mesosphere. Author

N73-18393*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FULL NONLINEAR TREATMENT OF THE GLOBAL THERMOSPHERIC WIND SYSTEM. PART 1: MATHEMATICAL METHOD AND ANALYSIS OF FORCES
P. W. Blum and I. Harris Jan. 1973 61 p refs Submitted for publication
(NASA-TM-X-66189; X-621-73-35) Avail: NTIS HC $5.25 CSCL 04A

The equations of horizontal motion of the neutral atmosphere between 120 and 500 km are integrated with the inclusion of all the nonlinear terms of the convective derivative and the viscous forces due to vertical and horizontal velocity gradients. Empirical models of the distribution of neutral and charged particles are assumed to be known. The model of velocities developed is a steady state model. In part 1 the mathematical method used in the integration of the Navier-Stokes equations is described and the various forces are analysed. Author

N73-18394# Lockheed Missiles and Space Co., Palo Alto, Calif.
OSCILLATIONS OF THE ION CONCENTRATION LEVEL IN THE EARTH'S IONOSPHERE AT 200 - 1300 km ALTITUDES
S. I. Borisov and V. D. Nikolaev [1972] 6 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 10, no. 6, 1972 p 892-896
Avail: NTIS HC $300; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Ion concentrations were measured on three orbits with differing apogees by using apparatus mounted on the Cosmos-434. The results of the experiments afford the possibility of estimating the influence of the earth's shadow on the ion concentration level. On the basis of the data obtained, a preliminary conclusion is made that as the altitude increases, the reduced concentration on the boundary of earth's shadow can shift during the morning hours local time into the ionosphere domain

illuminated by the sun, and the extent of this domain can be increased. Author

N73-18395# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE THEORY OF THE DIURNAL OSCILLATIONS OF THE MAGNETIC TAIL OF THE EARTH
A. I. Ershkovich and S. V. Sobolev [1972] 4 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 10, no. 6, 1972 p 888-891
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The diurnal oscillations of the earth's magnetic tail, which originate because of precession of the earth's magnetic axis around the axis of rotation, are studied. The tail is considered as a plasma cylinder separated from the solar wind by a surface of tangential discontinuity. The computed amplitudes of the oscillations agree with satellite measurements. Author

N73-18396*# University of Southern Mississippi, Hattiesburg.
REMOTE SENSING STUDY OF LAND USE AND SEDIMENTATION IN THE ROSS BARNETT RESERVOIR, JACKSON, MISSISSIPPI AREA
W. T. Mealor, Jr., T. W. Pinson, D. L. Wertz, C. M. Hoskin, and D. C. Williams [1972] 97 p
(Grant NGL-25-005-007)
(NASA-CR-130960; AR-1) Avail: NTIS HC $7.00 CSCL 08H

This multi-year study is aimed at focusing on the recognition of sediment and other affluents in a selected area of the Ross Barnett Reservoir. The principle objectives are the determination of land use types, effect of land use on erosion, and the correlation of sediment with land use in the area. The I2S multi-band imagery was employed in conjunction with ground truth data for both water and land use studies. The selected test site contains approximately forty square miles including forest, open land, and water in addition to residential and recreational areas. J.M.M.

N73-18397*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
TIME VARIATIONS OF MAGNETOSPHERIC INTENSITIES OF OUTER ZONE PROTONS, ALPHA PARTICLES AND IONS (Z GREATER THAN OR EQUAL TO 2) Ph.D. Thesis
Bruce A. Randall Jan. 1973 73 p refs
(Contracts NAS1-8141; N00014-68-A-0196-0003)
(NASA-CR-130860; U-of-Iowa-73-3) Avail: NTIS HC $5.75 CSCL 04A

A comprehensive study of the temporal behavior of trapped protons, alpha particles and ions ($Z > 2$) in outer zone of the earth's magnetosphere has been made. These observations were made by the Injun V satellite during the first 21 months of operation, August 1968 to May 1970. Rapid increases in the observed number of particles followed by slower exponential decay characterize the data. Comparisons are made with the temporal behavior of interplanetary particles of the same energy observed by Explorer 35. Increases in the trapped fluxes generally correspond to enhanced interplanetary activity. The energy spectra of protons and alpha particles at $L = 3$ have similar shapes when compared on an energy per charge basis while the respective polar cap spectra have similar shape on an energy per nucleon basis. Apparent inward trans-L motion of energetic protons is observed. These particles are diffused inward by a process involving fluctuating electric fields. The loss of trapped low altitude protons, alpha particles and ions ($Z > 2$) is controlled by coulombic energy loss in the atmosphere. Author

N73-18398*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE REACTION OF O(1 D) WITH H2O AND THE REACTION OF OH WITH C3H6
R. Simonaitis and Julian Heicklen 5 Sep. 1972 26 p refs
(Grants NGL-39-009-003; NSF GA-12385)
(NASA-CR-130976; PSU-IRL-SCI-397) Avail: NTIS HC $3.50 CSCL 04A

The N2O was photolyzed at 2139 A to produce O(1 D) atoms in the presence of H2O and CO. The O(1 D) atoms react with H2O to produce HO radicals, as measured by CO2 production from the reaction of OH with CO. The relative rate constant for O(1 D) removal by H2O compared to that by N2O is 2.1. In the presence of C3H6, the OH can be removed by reaction with either CO or C3H6. Author

N73-18399*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE PHOTOLYSIS OF OZONE
Eduardo Lissi and Julian Heicklen 4 Feb. 1972 65 p refs
(Grants NGL-39-009-003; NSF GA-12385)
(NASA-CR-130830; PSU-IRL-SCI-387) Avail: NTIS HC $5.25 CSCL 04A

Ozone was photolyzed at 25 C with steady illumination at several wavelengths from 2288 to 2850 A, at O3 pressures from 0.1 to 2.7 torr, and at absorbed intensities from 0.15 to 65 microns/min. Experiments were done in pure dry O3, and in the presence of He, CO2, N2, H2O, H2, N2O, He-CO2, He-H2O, CO2-H2O, O2-N2O, CO2-O2, and N2O5-O2-CO2 mixtures. The results show that in the absence of added gases or in the presence of He, the quantum yield of O3 consumption is 5.5 independent of conditions, except at pressures below 0.4 torr. In the presence of CO2 or N2, ozone consumption falls toward 4.0. The primary photolytic act produces O(1 D) and siglet O2, presumably O2(1 delta), at all wavelengths below 3000 A. Relative quenching constants O(1 D) removal by various gases were measured at 2288, 2537, and 2800 A. For O3, CO2, and N2, the relative rates are 1.0/0.4 to 0.5/0.08 to 0.11 at all wavelengths. For H2O the constant at 2537 A is 1.5 relative to that for O3. With N2O, a noticeable wavelength effect is observed and the relative rate constants are 1.5, 2 to 3, 4.0 for O3 compared to N2O at 2800, 2537, and 2288 A, respectively. Author

N73-18400*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF THE TOTAL OUTGOING RADIANCE OF THE EARTH-ATMOSPHERE SYSTEM
Musa Pasternak Jan. 1973 30 p refs Submitted for publication
(NASA-TM-X-66195; X-651-73-48) Avail: NTIS HC $3.50 CSCL 04A

Utilizing eighty atmospheric models, the equivalent black body temperatures for the 6-7, 10-11, 15-16 and the 20-24 micron spectral regions, corresponding to the Nimbus 3 medium resolution infrared radiometer were computed. The black body temperatures for the 5-30 micron channel and the total outgoing radiances for these atmospheres were also computed. It was found that the total radiation can be estimated from the 10-11 micron channel alone with a standard error of 2.2 watts/sq m sr.
Author

N73-18401# National Ocean Survey, Rockville, Md.
PACIFIC SEAMAP 1961 - 1970 DATA FOR AREAS 15636-12, 15642-12, 16836-12, AND 16842-12: LONGITUDE 156 DEG W TO 180 DEG W, LATITUDE 36 DEG N TO 48 DEG N. BATHYMETRY, MAGNETICS AND GRAVITY
E. F. Chiburis (Conn. Univ.), J. J. Dowling (Conn. Univ.), P. Dehlinger (Conn. Univ.), and M. J. Yellin Jul. 1972 626 p refs
(NOAA-TR-NOS-51) Avail: SOD $11.00

Processed bathymetry, magnetic, and gravity data, collected between 1961 and 1969 in the North Central Pacific area bounded by longitudes 156 W and 180 W and latitudes 36 N and 48 N are listed in computer printout format. More than 30,000 evaluated data points from Project Pacific SEAMAP surveys are included. These surveys were initiated in 1961 by the Coast and Geodetic Survey and continued after July 1965 by the C&GS under the Environmental Science Services Administration and after October 1970 by the National Ocean Survey of the National Oceanic and Atmospheric Administration. The listing identifies the vessel, cruise, position and time of each bathymetric measurement, corrected depth, correction applied for sound velocity variation, total magnetic field intensity, magnetic anomaly, observed gravity, free-air gravity anomaly, and gravity meter used. Author

N73-18402*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EARTH RESOURCES REQUIREMENTS SKYLAB MISSIONS SL-1/SL-2, SL-3, AND SL-4. APPENDIX B: MISSION REQUIREMENTS
Dec. 1972 227 p

(NASA-TM-X-69137; MSC-1-MRD-001-App-B) Avail: NTIS HC $13.50 CSCL 22A

Earth resources requirements to be investigated by Skylab missions 1 through 4 are presented tabularly. Areas to be investigated include: (1) agriculture, range, and forestry; (2) geology; (3) continental water resources; (4) ocean investigations; (5) atmospheric investigations; (6) coastal zones, shoals, and bays; (7) remote sensing techniques; and (8) cartography.
A.L.

N73-18403# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Feb. 1972 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, FEVRIER 1972]
Feb. 1972 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) are presented relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during February 1972.
ESRO

N73-18404# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Mar. 1972 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, MARS 1972]
Mar. 1972 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during March 1972 are presented.
ESRO

N73-18405# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Apr. 1972 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, AVRIL 1972]
Apr. 1972 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during April 1972 are presented.
ESRO

N73-18406# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, May 1972 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, MAI 1972]
May 1972 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during May 1972 are presented.
ESRO

N73-18407# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Jun. 1972 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, JUIN 1972]
Jun. 1972 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during June 1972 are presented.
ESRO

N73-18408# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Jul. 1972 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, JUILLET 1972]
Jul. 1972 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during July 1972 are presented.
ESRO

N73-18409# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jul. 1972 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, JUILLET 1972]
Jul. 1972 31 p In DUTCH and FRENCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for July 1972.
ESRO

N73-18410*# California Univ., Riverside. Dept. of Geography.
STUDIES IN REMOTE SENSING APPLICATIONS. BARRIERS TO INNOVATION: THE EXAMPLE OF REMOTE SENSING IN URBAN AND REGIONAL PLANNING IN THE LOS ANGLES METROPOLIS. INTERFACING REMOTE SENSING AND AUTOMATED GEOGRAPHIC INFORMATION SYSTEMS
Darryl R. Roehring, Jene S. McKnight, David A. Nicholas, and William G. Brooner Sep. 1972 70 p refs
(Grant NGL-05-003-404; Contract N00014-69-A-0200-5001)
(NASA-CR-130969; AD-752058; TR-T-72-2; TR-T-72-3) Avail: NTIS HC $5.50 CSCL 08B

Some items are presented in a five stage approach which are deemed necessary for employment of remote sensing and automated information systems in a land management program. The approach synthesizes research which has recently led to the development of operational systems.
Author (GRA)

N73-18411# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENT IN THE SIMULTANEOUS INVESTIGATIONS OF THE THREE-DIMENSIONAL STRUCTURE OF A RADIATION FIELD IN THE ATMOSPHERE USING EQUIPMENT INSTALLED ON AIRPLANES, BALLOONS, AND SATELLITES
E. P. Barashkova, V. L. Gaevskii, K. Ya. Kondratyev, and G. A. Nikolskii 15 Aug. 1972 32 p refs Transl. into ENGLISH from Tr. Issled. Radiats. Protsessov v Atm. Vopr. Sputnikovoi Meteorol. (USSR), no. 235, 1970 p 7-23
(AD-750962; FTD-HT-23-257-72) Avail: NTIS CSCL 04/1

An experiment in simultaneous investigations of the three-dimensional structure of a radiation field in the atmosphere using equipment installed on the ground (actinometric net), an airplane, balloon, and satellite is presented. The experiment was conducted on 27 June 1967 using Cosmos-156, an airplane at an altitude of 8.4 km, and a balloon at an altitude of 30 km. Instruments used were a pyranometer and scanning and wide-angle actinometric equipment. Results are discussed.
GRA

N73-18412# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
OPTICAL PROPERTIES OF THE ATMOSPHERE (THIRD EDITION)
R. A. McClatchey, R. W. Fenn, J. E. A. Elby, F. E. Volz, and J. S. Garing 24 Aug. 1972 115 p refs
(AF Proj. 7670)
(AD-753075; AFCRL-72-0497; AFCRL-ERP-411) Avail: NTIS CSCL 04/1

A series of tables and charts is presented from which the atmospheric transmittance between any two points in the terrestrial atmosphere can be determined. This material is based on a set of five atmospheric models ranging from tropical to arctic and two aerosol models. A selected set of laser frequencies has been defined for which monochromatic transmittance values have been given. For low resolution transmittance prediction, a series of charts has been drawn providing the capability for predicting transmittance at a resolution of 20 wave-numbers. Separate sections are included on scattered solar radiation, infrared emission, refractive effects, and attenuation by cloud and fog. This third edition differs from the others in that the low resolution spectral curves for the uniformly mixed gases and in the short wavelength region for water vapor have been revised, providing some overall improvement in accuracy; and more importantly, an appendix has been added providing model data and equivalent sea level path data for the U.S. Standard Atmosphere, 1962.
Author (GRA)

N73-18413# Signatron, Inc., Lexington, Mass.
DEVELOPMENT OF A FORWARD SCATTER WIDEBAND

ATMOSPHERIC PROBING TECHNIQUE Final Report, 16 Aug. 1971 - 14 Jun. 1972
Edward Getchell, Peter Alexander, Paul Mahoney, Helge Nilssen, and Howard Salwen 26 Sep. 1972 93 p refs
(Contract F19628-71-C-0082; AF Proj. 8680)
(AD-753090; A-117/F; AFCRL-72-0576) Avail: NTIS CSCL 04/1

The report is concerned with the study, design, and fabrication of a modulator/demodulator suitable for probing and analyzing a forward scatter path at 15 GHz to determine clear air turbulence (CAT) in the common volume. The equipment is called wide-band prober-analyzer. The prober part at the transmitter consists of a Gunn Source and a modulator generating a biphase signal switched at the maximum rate of 12.5 Mbps. The analyzer part at the receiver site performas on-line processing to permit real-time measurement of forward-scattered power, Doppler offset and Doppler RMS spread as a function of signal delay. Direct display of amplitude and frequency information is provided.
Author (GRA)

N73-18414# Ghana Univ., Legon. Dept. of Physics.
IONOSPHERIC RESEARCH USING SATELLITES: AN INTERPRETATION OF IONOSPHERIC FARADAY ROTATION OBSERVATIONS AT THE EQUATOR Final Scientific Report, 1 Jan. - 31 Dec. 1971
John R. Koster and Tom Beer 23 Jun. 1972 83 p refs
(Contract F61052-70-C-0004; AF Proj. 4643)
(AD-753088; AFCRL-72-0606) Avail: NTIS CSCL 04/1

The Faraday rotation angle phi of the radio signal from ATS-C has been continuously measured at Legon for several years. The curves show unexpected minima and maxima in the post-sunset period. Recently the signal from Intelsat 2F-2 has been measured simultaneously. Comparison of the curves from the spaced satellites shows that the occurrence of the minima and maxima depends primarily on local solar time, with appropriate time shifts for the two satellites. The seasonal dependence of scintillation at Legon is shown for a period of four years. An explanation of this seasonal dependence is attempted in terms of the time of sunset at the base of the F region field lines over Legon. Results fit Legon observations well, but seem to be at variance with South American results. In the light of the observed F region behavior a new theory of equatorial spread F is proposed. Author (GRA)

N73-18415# Naval Research Lab., Washington, D.C.
SIMULATION OF GYRORESONANT ELECTRON-WHISTLER INTERACTIONS IN THE OUTER RADIATION BELTS Interim Report
Sidney L. Ossakow, Edward Ott, and Irving Haber Nov. 1972 22 p refs
(AD-753196; NRL-MR-2532) Avail: NTIS CSCL 04/1

The authors present results on computer simulation of whistler turbulence and velocity space diffusion in a magnetospheric-type plasma. This is an extension of previous work, where, here, the authors have raised the ratio of plasma frequency to cyclotron frequency and lengthened the system size. This has been done in order to bring the parameters more into the physical regime corresponding to the outer radiation belts. Author (GRA)

N73-18416# Center for the Environment and Man, Inc., Hartford, Conn.
NUMERICAL MODEL STUDIES OF UNDERLYING SURFACE EFFECTS ON CUMULUS-SCALE ATMOSPHERIC CONVECTION Final Report, 1 Apr. 1970 - 31 Oct. 1972
Richard S. Greenfield 30 May 1972 63 p refs
(Contract DAHC04-70-C-0030)
(AD-752914; CEM-4079-474; AROD-8708-1-EN) Avail: NTIS CSCL 04/1

The report presents the results of the first stages of an investigation into the effects of surface characteristics on cumulus scale convection. The basic formulation of moist convection generally, the parameterized boundary layer and the solution scheme, are presented. The experimental design that has been developed to respond to two basic aspects of the investigation of the surface effects on convection is detailed. Some preliminary results are discussed for two runs, one having a stable boundary layer and one an unstable boundary layer; both above smooth (z_0) = 1 cm), relatively dry ground. These results are compared to a bench mark simulation having a closed lower boundary with a slip condition. Finally, a comparative investigation of several finite-difference schemes covers both explicit and implicit schemes as well as several numerical experiments using a dry-convection model with no boundary layer. Author

N73-18417# Denver Univ., Colo. Dept. of Mathematics.
NUMERICALLY GENERATED RAY PATTERNS FOR INTERNAL WAVES IN A STRATIFIED FLUID OF VARIABLE ALTITUDE OR DEPTH
David L. Hector and Charles C. H. Wang Nov. 1972 46 p ref
(Grants AF-AFOSR-2306-72; AF-AFOSR-1923-70)
(AD-753126; MS-R-7306; AFOSR-72-2418TR) Avail: NTIS CSCL 08/3

The report describes some numerical studies carried out to establish an understanding of the temporal propagation of internal waves in the atmosphere or an ocean of variable altitude or depth. The theory the authors are employing here was developed in a previous paper by Hector, Cohen and Bleistein. In that paper an asymptotic theory for the propagation of small perturbation internal waves was developed. The present report is concerned with applying this asymptotic theory to time dependent fluid flows associated with specific kinds of internal wave propagation. Author (GRA)

N73-18418# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NO. 35, JULY 1972
Jul. 1972 29 p refs
(Contract DASA01-70-C-0035; DASA Proj. NWER-HD-010)
(AD-753016) Avail: NTIS CSCL 07/4

The issue presents summaries of recent progress reports and other informal information of current interest in the reaction rate field. It primarily presents studies of interest in aeronomy and atom, molecule, and ion interaction research. GRA

N73-18419# DBA Systems, Inc., Melbourne, Fla.
DESCRIPTION AND EVALUATION OF THE BENT IONOSPHERIC MODEL, VOLUME 1 Final Report, 28 Jun. - 27 Oct. 1972
Rodney B. Bent, Sigrid K. Llewellyn, and Margaret K. Walloch Oct. 1972 144 p refs
(Contract F04701-72-C-0380)
(AD-753081; SAMSO-TR-72-239-Vol-1) Avail: NTIS CSCL 04/1

The study is directed towards evaluating a world-wide empirical ionospheric model by comparing it with electron content data obtained from Faraday rotation measurements. The results are intended to assist in the design and implementation of a satellite navigational system which depends on signal ranging and hence the delay effects due to the ionosphere. The world-wide ionospheric model is evaluated in detail and the mean, standard deviation and root mean square of the residuals are computed along with correlation coefficients and cumulative probability distributions. Model update procedures and results are discussed where the update data is obtained from 1 to 9 hours prior to evaluation. The results show the capability of the model to remove a high proportion of the ionospheric effects but the conclusions indicate that caution is needed in reading too much optimism into these overall values and imply that diurnal trends should be reviewed in detail. Certain update procedures considerably improve the ionospheric residual during periods of high ionospheric density. Recommendations for future study and implementation of a model into the system are discussed.
Author (GRA)

N73-18420# DBA Systems, Inc., Melbourne, Fla.
DESCRIPTION AND EVALUATION OF THE BENT IONOSPHERIC MODEL, VOLUME 2
Rodney B. Bent, Sigrid K. Llewellyn, and Margaret K. Walloch Oct. 1972 235 p
(Contract F04701-72-C-0380)
(AD-753082; SAMSO-TR-72-239-Vol-2) Avail: NTIS CSCL 04/1

Volume 2 contains the statistical data for the evaluation conditions which are listed in detail in Volume 1. Each page is self-explanatory and displays either the diurnal mean, standard deviation or RMS residual for each month and condition, or the

corresponding cumulative probability distributions for the entire period. The results are quoted in electron content and group delay time at 1600 MHz. Author (GRA)

N73-18421# DBA Systems, Inc., Melbourne, Fla.
DESCRIPTION AND EVALUATION OF THE BENT IONOSPHERIC MODEL, VOLUME 3
Rodney B. Bent, Sigrid K. Llewellyn, and Margaret K. Walloch Oct. 1972 245 p
(Contract F04701-72-C-0380)
(AD-753083; SAMSO-TR-72-239-Vol-3) Avail: NTIS CSCL 04/1

Volume 3 contains the statistical data for the evaluation conditions which are listed in detail in Volume 1. Each page is self-explanatory and displays either the diurnal mean, standard deviation or RMS residual for each month and condition, or the corresponding cumulative probability distributions for the entire period. The results are quoted in electron content and group delay time at 1600 MHz. Author (GRA)

N73-18422# Naval Research Lab., Washington, D.C.
WIND WAVE STUDIES. PART 1: DOPPLER SPECTRA Final Report
J. W. Wright, J. R. Duncan, and W. C. Keller 8 Nov. 1972 26 p refs
(NRL Proj. R07-17; RR0210141)
(AD-753199; NRL-7473-Pt-1) Avail: NTIS CSCL 08/3

Previous measurements of Doppler spectra in microwave backscattering in a wind wave tank at 9.375 and 23.9 GHz have been extended to 70.1 GHz at a 3-m fetch and to longer fetches and higher winds at the lower microwave frequencies. The development of the Doppler spectra with fetch and windspeed leads to the identification of three scattering wave systems. At high angles, the dominant wind waves are the dominant scatterers; the scatterers at the lower angles comprise wave systems which are respectively bound to and free of the dominant wave. The free waves are treated as a perturbation of the wind drift, and the relation of free-wave growth to the wave-breaking process is discussed. Author (GRA)

N73-18423*# California Univ., Berkeley. Space Sciences Lab.
ON THE RELATIONSHIP BETWEEN THE GROWTH AND EXPANSION PHASES OF SUBSTORMS AND MAGNETOSPHERIC CONVECTION
Forrest S. Mozer 5 Jul. 1972 15 p refs
(Contracts NAS5-10362; NAS9-9502;
N00014-69-A-0200-1015; Grants NSF GA-1317; NSF GA-111259; NSF GA-17328)
(NASA-CR-130499; AD-745563; SSL-Ser-13-Issue-63) Avail: NTIS HC $3.00 CSCL 04A

It is suggested that the definition of the growth and expansion phases of substorms should rest on magnetospheric convection theories and data because of the ambiguities in interpretation of ground magnetometer records from which these concepts arose originally. Data such as that discussed in the report offers strong evidence for the validity and usefulness of the concepts of the growth and expansion phases. Author (GRA)

N73-18424# Army Engineer Topographic Labs., Fort Belvoir, Va.
NEW INSIGHTS AND RESULTS REGARDING L. F. RICHARDSON'S TURBULENCE CRITERION
Hans Baussus VonLuetzow Jun. 1972 16 p refs
(AD-746624; USAETL-RN-72-2) Avail: NTIS CSCL 04/1

New and less restrictive filter conditions for the horizontal equations of motion together with the thermodynamic energy equation lead to a more powerful omega-equation in the (x,y,p,t) system. The ellipticity condition for this three-dimensional partial differential equation provides a more general turbulence criterion than Richardson's, which was derived under simplified assumptions. The new condition for the existence of hydrostatic flow also explains the failure associated with the establishment of a certain number. Author

N73-18425# Naval Postgraduate School, Monterey, Calif.
THE FORM OF LATERAL VISCOSITY IN ATMOSPHERIC FLOWS M.S. Thesis
Orlin Robert Scrivener Sep. 1972 65 p refs
(AD-753619) Avail: NTIS CSCL 04/1

Long term numerical integrations were performed on a two-dimensional model using the barotropic vorticity equation including a space- and time-dependent forcing function and a laminar-type viscosity term. Three different forms of the laminar type viscosity or dissipation term were used. A comparison was made of the effects these different dissipation terms had on the time-dependence of total kinetic energy, and total gradient of vorticity squared, the spectral distribution of kinetic energy, and the stream function field. A difference of behavior of the above variables was found for each form of dissipation. GRA

N73-18426# Princeton Univ., N.J.
RADIATION INDUCED F-REGION PLASMA PHENOMENA
Francis W. Perkins and Ernest J. Naleo Griffiss AFB, N. Y. RADC May 1972 31 p refs
(Contract F30602-72-C-0053; ARPA Order 1423)
(AD-753162; RADC-TR-72-263) Avail: NTIS CSCL 04/1

Collective plasma phenomena induced in the ionospheric F-region by intense high-frequency radiation are examined on several time and length scales. The short wavelength, high-frequency turbulence associated with the observed high-frequency enhanced electron density fluctuations at the electron plasma frequency is shown to result from parametric excitation of plasma and acoustic waves by the high-frequency radiation. The wave kinetic equation describing the non-linear evaluation of the turbulence is presented. The time asymptotic spectral intensity is calculated and a formula for the total energy absorption from the incident radiation via nonlinear collective effects is obtained. A radiation induced self-focussing instability is found on a length scale somewhat larger than an ion Larmor radius, and is offered as a possible explanation for the occurrence of magnetic field aligned density filaments, which are associated with the phenomenon of artificial Spread-F. The calculated growth rates are in agreement with the time delay for appearance of Spread-F after modifier turn on. Author (GRA)

N73-18427# Naval Research Lab., Washington, D.C.
SOME MEASUREMENTS OF ACOUSTIC NORMAL MODE PROPAGATION IN SHALLOW WATER Interim Report
A. E. Schuetz 16 Nov. 1972 24 p refs
(RF05552404)
(AD-753200; NRL-7493) Avail: NTIS CSCL 08/10

Experiments were conducted in the northern Gulf of Mexico during July 1969 and March 1970 to study propagation characteristics of acoustic normal modes. This shallow-water area had a constant depth (31 plus or minus 2.5 m) over a propagation path of at least 20 km along a bearing line of 285 degrees T. Short-pulse, 3 cycle signals were emitted from 400- or 750-Hz center frequency sources. The vertical distributions of pressure amplitude of each of the two lowest order normal modes of these signals, measured by a vertical line of hydrophones, agreed well with distributions calculated by computer using a two-layer fluid model. Temporal variations of modal intensity averaged over depth for both the first and the second modes were observed for 7-min runs. Author (GRA)

N73-18428# Makai Range, Inc., Waimanalo, Hawaii.
AP-5 CRUISE Operations Final Report
8 Dec. 1972 55 p Prepared in cooperation with Hawaii Inst. of Geophys.
(Contract N00014-72-C-0489)
(AD-752840) Avail: NTIS CSCL 08/10

A detailed environmental survey of a specified area in the Pacific Ocean, northeast of Hawaii, was conducted on the R/V KANA KEOKI in September and October of 1972. The primary objective of this survey was to locate a North-South track, for a future acoustic experiment, that can be accurately represented in existing acoustic propagation models. Additional objectives included the collection of detailed bathymetric surveys of two 20 by 30 mile areas, XBT data to define the sound speed structure in the upper 2500 feet of the water column, and deep ocean casts to the bottom to define the deep water sound velocity, temperature, and salinity structures. GRA

N73-18429# Lamont-Doherty Geological Observatory, Palisades, N.Y.
ACOUSTIC PROPERTIES OF THE SEA FLOOR RELEVANT

TO LONG-RANGE SONAR PERFORMANCE IN THE OCEANS Final Report, May 1970 - Jun. 1971
George M. Bryan Dec. 1972 16 p refs
(Contract N00024-70-C-1344)
(AD-753265) Avail: NTIS CSCL 08/10

The overall objective of this research is an understanding of the relationship between the physical structure of the sea floor and its acoustic response, so that knowledge of one can be used to make inferences about the other. Inferences in both directions are important: the use of acoustics to investigate the physical and geophysical nature of the ocean floors is well known. Equally important is the ability to predict the acoustic response of the sea floor on the basis of its measurable physical properties. GRA

N73-18430# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
GROUND TRUTH REQUIREMENTS FOR REMOTE SENSOR DATA ACQUISITION AND ANALYSIS Final Report
Lewis E. Link, Jr. Nov. 1972 49 p refs
(DA Proj. 4A0-62112-A-854)
(AD-752420; AEWES-Misc-Paper-M-72-8) Avail: NTIS CSCL 08/6

Over the past few years airborne remote sensor devices have been developed for different regions of the electromagnetic spectrum that are capable of collecting data on the reflective and emissive properties of terrain. However, experience has shown that the capability to collect data of this type is not, in itself, sufficient to permit its fullest use. In almost every case, data collected with an airborne electromagnetic sensing system (remote sensor) must be augmented by data that define conditions existing in the environment at the time the remote sensor was used. The environmental factors that influence the electromagnetic energy received by remote sensing devices are defined for the following spectral regions: (a) gamma ray, (b) ultraviolet, (c) visible, (d) infrared, and (e) microwave. In addition, the remote sensing devices used in each spectral region are discussed and the environmental factors appraised for relative importance with respect to the final remote sensing product. Author (GRA)

N73-18431# Aerodyne Research, Inc., Burlington, Mass.
ANALYSIS OF ELECTRON BEAM IRRADIATION OF THE UPPER ATMOSPHERE Final Report, 15 Feb. - 14 Sep. 1972
Fritz Bien Sep. 1972 49 p refs
(Contract F30602-72-C-0271; ARPA Order 1649)
(AD-753707; ARI-RR-11; RADC-TR-72-297) Avail: NTIS CSCL 04/1

A study has been made of the physics and chemistry involved when energy is deposited into the upper atmosphere by electrons. Calculations have been made both of the size and shape of the electron interaction region and of the radiation intensity produced in that region. The results of the NASA artificial aurora experiment performed by Hess et al., in 1969 has been analyzed in this context. The emission produced from electron interaction with the atmosphere in the 3500 to 8000A region has been analyzed. The size and shape of the observed region have been calculated by fitting laboratory measurements to the earth's exponential atmosphere, taking into account the geomagnetic field and are attributed to prompt radiation from N2(-) first negative, N2 first positive, and O2(-) first negative, as well as to the afterglow radiation from OI 5577A and 6300A emitters. The calculated time dependence of the afterglow signal was found to be consistent with observations. Author (GRA)

N73-18432# Aerospace Corp., El Segundo, Calif. Lab. Operations.
COMPILATION OF SCIENTIFIC RESULTS FROM THE SATELLITE OV1-15 (SPADES) Technical Report, Jul. 1968 - Dec. 1970
Hugo R. Rugge 15 Nov. 1972 237 p refs
(Contract F04701-72-C-0073)
(AD-753680; TR-0073(3260-10)-1; SAMSO-TR-72-259) Avail: NTIS CSCL 04/1

The compilation consists of all scientific papers published by Space Physics Laboratory scientists up to February 1972 that are based on data obtained wholly, or in part, from the OV1-15 satellite. In addition, a brief description of the OV1-15 satellite and a list of presentations on OV1-15 results are included. Author (GRA)

N73-18433# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE MORPHOLOGY OF IONOSPHERIC F-REGION STORMS AT MIDDLE AND LOW LATITUDE M.S. Thesis
William F. McCullough Dec. 1972 143 p refs
(AD-753665; GEP/PH/73-14) Avail: NTIS CSCL 04/1

The dependence of the onset time of the F-region electron density disturbance upon the local time of the geomagnetic storm commencement and main phase onset was investigated. Hourly value of the fractional deviations of foF2 from monthly median values at a world-wide network of ionosonde stations were examined during 29 geomagnetic storms occurring between July 1957 and December 1964 with main phase onset time lags of more than 2 hours and K-indices at Fredericksburg of t or greater. The relationship between the relative equatorial electrojet strength and the time rate of change of foF2 above Huancayo was investigated during eight geomagnetic storms. The structural morphology of the equatorial anomaly during two geomagnetic storms was also investigated. Author (GRA)

N73-18434# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
CHARACTERISTICS OF THE TURBULENT DIFFUSION PARAMETERS AS RELATED TO STABILITY
Manuel Armendariz and James R. Scoggins (Tex. A&M Univ.) Ft. Monmouth, N. J. ECOM Nov. 1972 35 p refs
(DA Proj. 1T0-61102-B-53)
(AD-753350; ECOM-5468) Avail: NTIS CSCL 04/1

The objective of this study was to demonstrate the extent to which a difference in temperature (delta T) between two levels near the ground (static atmospheric stability) and the ratio z/L (dynamic atmospheric stability) is related to other parameters indicative of turbulence and diffusion. The data show, assuming that the rate of diffusion is determined by the intensity of turbulence, that (delta T) measured through a shallow layer near the ground is not a good indicator of diffusion rates, particularly when the atmosphere is statically unstable. The ratio z/L does not appear to be a significantly better indicator for defining atmospheric stability than (delta T) during highly unstable conditions. Author (GRA)

N73-18689* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA PROCESSING REQUIREMENTS FOR THE EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS)
John Y. Sos *In its* Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 61-70 (For availability see N73-18684 09-23)
CSCL 05B

N73-18638 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF UTILIZING MODERN SELF-CONTAINED BUOY STATIONS FOR OCEANOGRAPHIC RESEARCH IN STRONG CURRENT AREAS
A. S. Gorshkov, O. N. Goncharov, I. N. Davidan, L. N. Yevdokimova, Yu. V. Sustavov, and A. N. Krylov *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 71-80 refs (For availability see N73-18631 09-20)

N73-18639 Joint Publications Research Service, Arlington, Va.
WIND-DRIVEN CURRENTS WITH BOTTOM SLIPPING IN SHALLOW BODIES OF WATER
V. S. Sinelshchikov *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 81-89 refs (For availability see N73-18631 09-20)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-18435# National Environmental Satellite Service, Washington, D.C.
VERIFICATION OF OPERATIONAL SIRS B TEMPERATURE RETRIEVALS
Harold J. Brodrick and Christopher M. Hayden Dec. 1972 30 p refs
(NOAA-TR-NESS-63) Avail: SOD $0.55

A verification procedure is applied to determine the accuracy of the Satellite Infrared Spectrometer (SIRS) B temperature retrievals. Three pressure levels are considered. It is shown that temperatures derived from satellite data for application at 200 mb are definitely useful while at 500 and 300 mb, under certain cloud conditions, the SIRS temperatures are moderately useful. Author

N73-18436*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR CHECKING FIRE DETECTORS Patent Application
George T. Clawson, inventor (to NASA) Filed 26 Dec. 1972 16 p
(NASA-Case-GSC-11600-1; US-Patent-Appl-SN-318357) Avail: NTIS HC $3.00 CSCL 14B

A fire detector checking method and device are disclosed for nondestructively verifying the operation of installed fire detectors of the type which operate on the principle of ambient air temperature rise to sound an alarm when the temperature reaches a preset level. The fire alarm checker device uses the principle of effecting a controlled simulated alarm condition to ascertain whether or not the detector will respond. It is comprised of a hand-held instrument employing a controlled heat source to heat an enclosed mass of air in a first compartment, which is then disposed about the fire detector to be checked. A second compartment houses an electronic circuit to sense and adjust the temperature level and heating rate of the heat source. Actuation of a fire detector of the rate of rise type within a predetermined time interval after applying heated air mass verifies the soundness of the system. NASA

N73-18437*# Franklin Inst., Philadelphia, Pa. Science Information Services Dept.
PHOTOGRAPHY EQUIPMENT AND TECHNIQUES. A SURVEY OF NASA DEVELOPMENTS
Albert J. Derr 1972 188 p refs Original contains color illustrations
(Contract NASw-1981)
(NASA-SP-5099; LC-72-600108) Avail: NTIS MF $0.95; SOD HC $1.50 CSCL 14E

The Apollo program has been the most complex exploration ever attempted by man, requiring extensive research, development, and engineering in most of the sciences before the leap through space could begin. Photography has been used at each step of the way to document the efforts and activities, isolate mistakes, reveal new phenomena, and to record much that cannot be seen by the human eye. At the same time, the capabilities of photography were extended because of the need of meeting space requirements. The results of this work have been applied to community planning and ecology, for example, as well as to space and engineering. Special uses of standard equipment, modifications and new designs, as well as film combinations that indicate actual or potential ecological problems are described. Author

N73-18438# Bureau of Mines, Pittsburgh, Pa.
CHEMICAL FLAME INHIBITION USING MOLECULAR BEAM MASS SPECTROMETRY BROMOTRIFLUOROMETHANE IN LOW PRESSURE METHANE-OXYGEN-ARGON FLAMES
Joan C. Biordi, Charles P. Lazzara, and John F. Papp 1973 43 p refs
(BM-RI-7723) Avail: NTIS HC $4.25

A molecular beam-mass spectrometer-low pressure flat flame apparatus was constructed for the purpose of examining the chemical microstructure of normal methane-oxygen-argon flames and those inhibited with Halon extinguishants. Details of construction and performance of this apparatus and of related flame temperature measurements are given. Particular attention is paid to the empirical characterization of the perturbation to the flame caused by the sampling probes. The composition profiles obtained for normal flames are compared to those of flames inhibited by CF3Br. In addition to the usual stable species (CH4, O2, CO, CO2, H2O, H2, and H2CO), the inhibitor, its products and intermediates associated with its reactions, could be followed. In particular, hydrogen bromide, bromine atoms, hydrogen fluoride, and carbonyl fluoride were observed. The relatively rapid disappearance of inhibitor and early appearance of fluorinated reaction products suggest a short lifetime for the CF3 radical in this system. Observation of COF2 suggests that CF3Br is effective as an inhibitor, at least in part, by virtue of its interference with the oxygen containing species of the normal chain reaction. Profiles of the 17(+) peak at low electron energy suggests that the hydroxyl radical may also be sampled, but the profiles obtained are not yet sufficiently accurate to determine the effect of inhibitor on this important flame radical. Author

N73-18439# Advisory Group for Aerospace Research and Development, Paris (France).
DISPLAYS FOR APPROACH AND LANDING OF V/STOL AIRCRAFT
Nov. 1972 17 p
(AGARD-AR-51) Avail: NTIS HC $3.00 CSCL 01B

An analysis of the display systems required for approach and landing of V/STOL aircraft was conducted. The various factors considered in the analysis are: (1) operational factors and ground environment, (2) guidance requirements, (3) relation between control and display sophistication, (4) information requirements, (5) human factors engineering, and (6) current display devices. Diagrams of proposed instrument panels and display devices are included. Author

N73-18440# Bonn Univ. (West Germany). Physikalisches Inst.
CALIBRATION WITH SPECIAL REGARD TO OZONE OF A MASS SPECTROMETER WITH MODIFIED CRYO-COOLED ION SOURCE
D. Offermann, T. G. Scholz, and H. Gerhard Oct. 1972 45 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-32) Avail: NTIS HC $4.25; ZLDI Munich: 9.45 DM

The calibration of a mass spectrometer with a modified helium-cooled ion source is described. This instrument, in addition to the improvements in a first version of the cryo-cooled as compared to conventional uncooled ion sources is designed to freeze the shock front ahead of the entrance aperture of the ion source during supersonic rocket flights in the mesosphere and lower thermosphere, in order to enhance the reliability in measurements of reactive species like atomic oxygen and ozone. The ozone calibration was performed, relative to CO2, in a molecular-beam system which helium-cooled as well, to minimize wall-reactions in the system. In a second, uncooled, calibration system the instrument was additionally calibrated with non-reactive gases (CH4, N2, O2, Ar, CO2) at pressure ranging up to a few 0.1 torr, corresponding to mesospheric ambient pressure. Author

N73-18441# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
THE DFVLR-LIDAR-SYSTEM 3
H. Herrmann and Ch. Werner 1972 38 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-72-26) Avail: NTIS HC $4.00; DFVLF Porz: 11,60 DM

The DFVLR-LIDAR-System 3 is described. Ground based measurements of the water vapor density were carried out for altitudes up to 3 km. The transmitters are two ruby lasers. By thermally tuning the laser the operating wavelength can be tuned across a water vapor absorption line. The receiver is a Newtonian

telescope with 24.8 cm mirror diameter. The power meter and the data acquisition system are described. Author

N73-18442*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
MOIRE PATTERNS AND TWO-DIMENSIONAL ALIASING IN LINE SCANNER DATA ACQUISITION SYSTEMS
C. D. McGillem and T. E. Riemer 1973 24 p refs
(Grant NGL-15-005-112)
(NASA-CR-130829; LARS-111772) Avail: NTIS HC $3.25 CSCL 14B

The basic mechanism underlying the generation of Moire patterns in line scanner data acquisition systems is examined. A general expression is developed in terms of typical system parameters for the reproduced image of such systems and the interaction of the image spectrum; the raster frequency and digital sampling frequency of the A/D conversion process are discussed and examples given. Systems design requirements for avoiding Moire pattern generation and two-dimensional aliasing are discussed. Author

N73-18443*# Beckman Instruments, Inc., Fullerton, Calif.
SPECIFIC WAVELENGTH COLORIMETER Patent Application
Carle C. Brawner, Jr., Larry S. McDavid, and John M. Walsh, inventors (to NASA) Filed 13 Feb. 1973 27 p
(Contract NAS9-11879)
(NASA-Case-MSC-14081-1; US-Patent-Appl-SN-331760) Avail: NTIS HC $3.50 CSCL 14B

A self contained, specific wavelength, single beam colorimeter for direct spectrophotometric measurement of the concentration of a given solute in a test sample, is described. An electrical circuit employing a photo conductive cell converts the optical output into a linear, directly readable meter output. The colorimeter is simple to operate and is adapted for use in zero gravity conditions. In a specific application, the colorimeter is designed to analyze the concentration of iodine in potable water carried aboard a space vehicle such as the 4B stage of Skylab. NASA

N73-18444*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A LEAK DETECTOR Patent Application
James T. Sawyer, inventor (to NASA) Filed 5 Mar. 1973 17 p
(NASA-Case-MFS-21761-1; US-Patent-Appl-SN-337816) Avail: NTIS HC $3.00 CSCL 14B

A detector for sensing a leaking of fluid pressures is described. The detector is characterized by an hermetically sealed housing confining a first or normalized pressure, a connector for coupling the housing in direct communication with a suspected leak established within a substantially sealed body and an electrical circuit having a first normalized configuration. Also present is a pair of circuit-completing electrical contacts and a means for mounting at least one contact of the pair on a flexing wall of the housing. The wall supports contact for movement from a first position along a linear path to a second position in response to an altering of the pressure confined within the housing.
NASA

N73-18445*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A FLUIDIC DEVICE FOR MEASURING CONSTITUENT MASSES OF A FLOWING BINARY GAS MIXTURE
Paul R. Prokopius Washington Mar. 1973 17 p refs
(NASA-TM-X-2741; E-7159) Avail: NTIS HC $3.00 CSCL 14B

A continuous reading mass flow device was developed to measure the component flow of a binary gas mixture. The basic components of the device are a fluidic humidity sensor and a specially designed flow calorimeter. These components provide readings of gas mixture ratio, mixture heat capacity, heat dissipated by the calorimeter and the gas temperature rise across the calorimeter. These parameter values, applied in the general definitions of specific heat capacity and the heat capacity of a gas mixture, produce calculated component flow rates of the mixture being metered. A test program was conducted to evaluate both the steady state and dynamic performance of the device.
Author

N73-18446*# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF HIGH TEMPERATURE STRAIN GAGES Final Report
M. M. Lemcoe 5 Jan. 1973 135 p
(Contract NAS1-11277)
(NASA-CR-112241) Avail: NTIS HC $8.75 CSCL 14B

High temperature electric resistance wire strain gages were developed and evaluated for use at temperatures exceeding 922 K (1200 F). A special high temperature strain gage alloy (Fe-25Cr-7.5A1), designated BCL-3, was used to fabricate the gages. Pertinent gage characteristics were determined at temperatures up to 1255 K (1800 F). The results of the evaluation were reported in graphical and tabular form. It was concluded that the gages will perform satisfactorily at temperatures to at least 1089 K (1500 F) for at least one hour. Author

N73-18447*# Engelhard Minerals and Chemicals Corp., Carteret, N.J. Temperature Sensing Dept.
HIGH TEMPERATURE THERMOCOUPLE DEVELOPMENT PROGRAM, PART A AND PART B Final Report
D. A. Toenshoff, E. D. Zysk, and P. L. Fleischner (Natl. Beryllia Corp.) Oct. 1972 103 p refs
(Contract NAS3-10950)
(NASA-CR-120898) Avail: NTIS HC $7.25 CSCL 14B

The problem of extending the useful life of thermocouples intended for in-core and out-of-core thermionic applications in a vacuum environment at temperatures up to 2273 K for periods of time up to 10,000 hours was investigated. Many factors that may influence this useful life were examined, and a basic probe design was developed. With a few modifications, twenty-three thermocouple assemblies were fabricated. Generally the finished thermocouple consisted of solid doped W-3% Re and W-25% Re wires and high purity and high density BeO insulators, and was sheathed in a high purity tantalum tube. In a few probes, stranded thermocouple wires were substituted; commercial grade BeO was used; and in two cases, CVD W-22% Re tubing was used. Each of the components was made of the highest purity materials available; was subjected to special cleaning steps, and was assembled in a class 10,000 clean room. Pertinent physical and chemical properties were determined on each of the components. Special processing techniques were used in the fabrication of the high purity (99.95%), high density (over 95% of theoretical) BeO. Author

N73-18448*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE TECHNIQUES OF HOLOGRAPHIC PARTICLE SIZING
Robert L. Kurtz Washington Mar. 1973 21 p refs
(NASA-TR-R-404; M-454) Avail: NTIS HC $3.00 CSCL 14E

Depending on the mechanism of particle production, the resultant particle size and velocity distribution may range over several orders of magnitude. In general, if particle size information is desired from a given type generator, one must resort to some form of experimental determination of the distribution. If the source of particle production is a dynamic one involving a reasonable volume, holography provides a tailor-made particle size and velocity distribution detector. This is evidenced by the fact that holography allows the entire volume to be recorded on one exposure without any interference with the volume of interest. Herein lies a very important characteristic of the holographic particle detection technique: It provides a holographic nondestructive testing technique in the fullest sense of the definition of nondestructive testing. This report provides a description of three different systems useful in this technique and includes the experimental results from one of the holographic systems which was used to detect particle size and velocity distribution from the Skylab waste tank. Author

N73-18449*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LARGE SPACE TELESCOPE, PHASE A. VOLUME 1: EXECUTIVE SUMMARY Final Report
15 Dec. 1972 57 p 5 Vol.
(NASA-TM-X-64726-Vol-1) Avail: NTIS HC $5.00 CSCL 20F

The Phase A study of the Large Space Telescope (LST) is reported. The study defines an LST concept based on the broad mission guidelines provided by the Office of Space Science (OSS), the scientific requirements developed by OSS with the scientific

community, and an understanding of long range NASA planning current at the time the study was performed. The LST is an unmanned astronomical observatory facility, consisting of an optical telescope assembly (OTA), scientific instrument package (SIP), and a support systems module (SSM). The report consists of five volumes. The report describes the constraints and trade off analyses that were performed to arrive at a reference design for each system and for the overall LST configuration. A low cost design approach was followed in the Phase A study. This resulted in the use of standard spacecraft hardware, the provision for maintenance at the black box level, growth potential in systems designs, and the sharing of shuttle maintenance flights with other payloads. Author

N73-18450*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LARGE SPACE TELESCOPE, PHASE A. VOLUME 2: MISSION DESCRIPTION AND SYSTEM DESIGN CHARACTERISTICS Final Report
15 Dec. 1972 633 p refs 5 Vol.
(NASA-TM-X-64726-Vol-2) Avail: NTIS HC $33.75 CSCL 14B

For abstract see N73-18449

N73-18451*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LARGE SPACE TELESCOPE, PHASE A. VOLUME 3: OPTICAL TELESCOPE ASSEMBLY Final Report
15 Dec. 1972 538 p Prepared by Itek Corp., Lexington, Mass. 5 Vol.
(Contract NAS8-27948)
(NASA-TM-X-64726-Vol-3) Avail: NTIS HC $29.00 CSCL 20F

The development and characteristics of the optical telescope assembly for the Large Space Telescope are discussed. The systems considerations are based on mission-related parameters and optical equipment requirements. Information is included on: (1) structural design and analysis, (2) thermal design, (3) stabilization and control, (4) alignment, focus, and figure control, (5) electronic subsystem, and (6) scientific instrument design. Author

N73-18452*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LARGE SPACE TELESCOPE, PHASE A. VOLUME 4: SCIENTIFIC INSTRUMENT PACKAGE Final Report
15 Dec. 1972 648 p refs Prepared by Kollsman Instr. Corp., Elmhurst, N. Y. 5 Vol.
(Contract NAS5-23068)
(NASA-TM-X-64726-Vol-4) Avail: NTIS HC $34.50 CSCL 20F

The design and characteristics of the scientific instrument package for the Large Space Telescope are discussed. The subjects include: (1) general scientific objectives, (2) package system analysis, (3) scientific instrumentation, (4) imaging photoelectric sensors, (5) environmental considerations, and (6) reliability and maintainability. Author

N73-18453*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LARGE SPACE TELESCOPE, PHASE A. VOLUME 5: SUPPORT SYSTEMS MODULE Final Report
15 Dec. 1972 697 p 5 Vol.
(NASA-TM-X-64726-Vol-5) Avail: NTIS HC $7.00 CSCL 20F

The development and characteristics of the support systems module for the Large Space Telescope are discussed. The following systems and described: (1) thermal control, (2) electrical, (3) communication and data landing, (4) attitude control system, and (5) structural features. Analyses of maintainability and reliability considerations are included. Author

N73-18454*# Linguistic Systems, Inc., Cambridge, Mass.
ELEMENTS OF EXPERIMENTAL APPARATUS. GRIDS AND LATTICES, CONVERGENT CHANNELS, BENDS AND DEFLECTIONS
I. L. Povkh Washington NASA Mar. 1973 53 p refs Transl. into ENGLISH from the publ. "Aerodinamicheskiy Eksperiment v Mashinostroyenii" Moscow, Mashinostr. Press, 1965 p 137-172
(Contract NASw-2482)
(NASA-TT-F-14832) Avail: NTIS HC $4.75 CSCL 14B

Self-simulation problems of the working section of machines are discussed employing gas dynamic processes, such as turbines, compressors, IC engines, boilers, etc. Wind tunnels and other experimental assemblies and devices used for aerodynamic self-simulation studies and for flow parameter measurements are considered. Pneumatic methods for measuring flow rates and pressures, and methods for measuring aerodynamic forces, moments, and turbulence are described. Electrohydrodynamic and gas hydraulic analogs are also cited. Author

N73-18455# Arbeitsgruppe fuer Physikalische Weltraumforschung, Freiburg (West Germany).
PLASMA DIAGNOSTICS EXPERIMENTS OF THE AEROS SATELLITE [DIE PLASMADIAGNOSEEXPERIMENTE DES SATELLITEN AEROS]
A. Dumbs, R. Kist, E. Neske, and K. Spenner 1972 19 p In GERMAN Presented at the 5th DGLR Ann. Meeting, 4-6 Oct. 1972
(DGLR-Paper-72-070) Avail: NTIS HC $3.00

The equipment for the plasma diagnostics experiment to be flown aboard the German astronomical satellite Aeros is described. An impedance probe and a counter-voltage analyzer will be used to measure the density distribution and temperature of the ionospheric plasma. Performance of the equipment is described. ESRO

N73-18456# Giessen Univ. (West Germany). Abteilung Angewandte Kernphysik.
A COINCIDENCE SPECTROMETER FOR FAST NEUTRONS [EIN KOINZIDENZSPEKTROMETER FUER SCHNELLE NEUTRONEN]
H. Schneider, B. Richter, R. May, and H. Kloes Bonn Bundeswehramt 1972 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-4) Avail: NTIS HC $3.75; Bundeswehramt 25 DM

A spectrometer for fast neutrons is described. The energy is measured by proton recoil in a stilbene crystal. A coincidence circuit with a Li-6 glass scintillator detects the neutrons which are trapped in the stilbene crystal. The energies of neutrons from several (d,n)-reactions were measured in the range from 0.8 to 14 MeV. Author (ESRO)

N73-18457# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Inst. fuer Strahlenschutz.
AUTOMATED EVALUATION OF SOLID STATE TRACK DETECTORS USING AN ON-LINE FLYING SPOT SCANNING DEVICE [UNTERSUCHUNGEN ZUR AUTOMATISCHEN AUSWERTUNG VON KERNSPURDETEKTOREN MIT EINER ON-LINE-FLYING-SPOT-ANLAGE]
W. Abmayr Bonn Bundeswehramt 1972 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-34) Avail: NTIS HC $4.00; Bundeswehramt 25 DM

A flying spot scanner with on-line data transmission to a digital computer is described, to be used for evaluating particle tracks of a dielectric detector in a density range greater than 1000 tracks/sq cm. It is possible to solve various types of questions with suitable computer programs. The equipment is especially suited to measurement of track density, taking into account corrections for overlapping. The track-size distribution is measured, and a very small dependency of the corrected results on the level parameters is obtained. The method is demonstrated with pictures of alpha particle irradiated foils. Results of automatic measurements are compared with visual counting. ESRO

N73-18458# Siemens-Schuckertwerke A.G., Erlangen (West Germany).
NEW SEMICONDUCTORS FOR GAMMA AND X-RAY DETECTION [NEUE HALBLEITER ZUM NACHWEIS VON GAMMA - UND ROENTGENSTRAHLEN]
S. Roth and W. R. Willig Bad Godesberg, West Ger. Bundesmin fuer Building und Wiss. Oct. 1972 60 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und

Wiss.
(BMBW-FB-K-72-19) Avail: NTIS HC $5.00; Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Leopoldshafen, West Ger. $11.50 DM

An attempt was made to replace the conventional Ge and Si detectors with high resolution by Pb and Hg compounds which are more efficient and operate at higher temperatures. Energy resolution of alpha particle and detection of gamma-quanta with beta-PbO and PbI2 devices were possible up to elevated temperatures (PbI2: 130 C). Alpha particles were detected with alpha-PbO and HgI2 devices. In addition, research on semiconductor properties, such as photoconductivity, temperature dependence of dark currents, and thermally stimulated currents is described. Author (ESRO)

N73-18459# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
A QUANTITATIVE SCHLIEREN TECHNIQUE USING THE SEMI-SHADOW OF AN EDGE FOR CALIBRATION [EIN QUANTITATIVES SCHLIERENVERFAHREN MIT BENUTZUNG DES HALBSCHATTENS EINER KANTE ZUR EICHUNG]
Joachim Beinert Jan. 1972 36 p refs In GERMAN; ENGLISH summary
(WB-2/72) Avail: NTIS

A quantitative schlieren technique with photographic recording is described. To correlate the angular deflection of light and the photographic density on the film measured by a densitometer, an illumination and a density are produced on part of the schlieren photograph by means of a semishadow of an edge. The same light source is used to prepare the schlieren photograph and the semishadow. The illumination has the same spatial gradient as that produced by a schlieren object with a linear spatial gradient of the angular deflection of light. The shape and the distribution of luminance of the light source need not be known. The technique is therefore especially suited for high speed photography. Because a standard schlieren is used, good accuracy at higher sensitivities is also possible. Angular deflections in the range of about 0.00005 radians were measured during tests with an accuracy of a few percent. Author (ESRO)

N73-18460# Singer-Kearfott, Pleasantville, N.Y.
CESIUM MAGNETOMETER DEVELOPMENT Technical Report, 4 Oct. 1971 - 3 Oct. 1972
James H. Simpson 4 Oct. 1972 67 p refs
(Contract N00014-72-C-0087)
(AD-753060; KD-72-87) Avail: NTIS CSCL 17/6

The feasibility of building a two-cell cesium gradient magnetometer with a sensitivity of 0.1 m(gamma) has been demonstrated. The theory of operation of an optically pumped magnetometer has been used to determine the cell performance required to obtain a sensitivity of 0.1 m(gamma). A cell development program has resulted in buffered cesium cells which exhibited signal-to-noise ratios of 100 db (1 Hz) and traverse relaxation times of about 7 ms. Unbuffered cells with signal-to-noise ratios of 85 db and relaxation times of about 13 ms were also made. These cell performances are near, or above the theoretical requirements. Tests of a single sensor magnetometer showed a sensitivity of 1 m(gamma) for a 90 Hz magnetic field. Author (GRA)

N73-18461# Development and Resources Transportation Co., Silver Spring, Md.
THE PREDICTION OF CIVIL ENGINEERING PROBLEMS IN THE ARCTIC BY MEANS OF DUAL-CHANNEL I-R SCANNING AND AEROCHROME INFRARED PHOTOGRAPHY Final Report
Leonard A. LeSchack, Frederick H. Morse, William R. Brinley, Jr., Nancy G. Ryan, and Robert B. Ryan Jun. 1972 28 p refs
(Contract N00014-71-C-0396; ARPA Order 1772; NR Proj. 307-339)
(AD-753048; D/RT-8) Avail: NTIS CSCL 13/2

The document is a continuation of the research reported in N72-18474. The conclusions drawn from the research are reiterated and amplified somewhat with comparisons of single channel and product imagery, both compared with color photography of an area at which ice wedge polygons are seen on imagery but not on the photography. Since this research is clearly incomplete, the remainder of the report is devoted to detailed recommendations for advanced research to determine the utility of the dual-channel I-R scanner as an Arctic engineering tool. Author (GRA)

N73-18462# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
DESIGN AND CONSTRUCTION OF A HIGH TEMPERATURE LIQUID METAL SOLUTION CALORIMETER
D. L. Vieth and M. J. Pool Oct. 1972 89 p refs
(Contract DAHC04-69-C-0016)
(AD-752443; THEMIS-72-30; AROD-T-4-48-E) Avail: NTIS CSCL 11/6

The design consideration and calibration of a new single well liquid metal solution calorimeter for use at high temperature is described. The calorimeter has an operational temperature range of 500C to 1300C in a vacuum and was designed primarily to operate 1200C using liquid uranium as a solvent. Calibration was based on the heat content, between room temperature and the calorimeter temperature, of weighed samples of pure uranium. The partial heat of solution of vanadium, chromium, iron, and nickel in uranium at 1150C were determined. Author (GRA)

N73-18463# Army Behavior and Systems Research Lab., Arlington, Va.
EFFECTIVENESS OF AN ERROR KEY FOR IMAGE INTERPRETATION IN VIETNAM
Harold Martinek, Richard E. Hilligoss (N. Am. Rockwell, Inform, Systems Co. Anaheim, Anaheim, Calif.), and Bruce Herrington Sep. 1972 38 p refs
(DA Proj. 2Q6-62704-A-721)
(AD-752437; BESRL-TRN-230) Avail: NTIS CSCL 14/5

Experimentation to develop a specialized reference key to enable interpreters to avoid certain common errors in reporting information derived from imagery taken over Vietnam is reported in the present Technical Research Note. The research study, a joint effort of personnel of the Behavior and Systems Research Laboratory (BESRL) and of the North American Rockwell Information Systems Company (NARISCO), was undertaken to construct and validate a new type of reference -- an error key -- for use in Vietnam. The key was constructed from operational imagery of Vietnam territory with annotations pointing out types of error to be avoided. Evaluation was conducted using trained interpreters to determine if use of the error key would achieve the following effects on image interpreter reports: increase number of right responses; decrease number of wrong responses; and increase accuracy of identification. Author (GRA)

N73-18464# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
EVALUATION OF THE -S/N- FATIGUE LIFE GAGE UNDER CONSTANT AND VARIABLE AMPLITUDE LOADING Final Report
Maurice S. Rosenfeld and Sidney Scheindlinger 5 Sep. 1972 141 p refs
(ZFXX412)
(AD-753800; NADC-72071-VT) Avail: NTIS CSCL 01/3

An experimental program was conducted to evaluate the -S/N- Fatigue Life Gage and a number of gage installations was evaluated for constant and variable amplitude loading. The test results demonstrated that while there was a qualitative relation between gage resistance change and specimen life expended, a usable quantitative correlation was not attainable. Test results also proved that the fraction of specimen life to initial detectable crack was a better indicator of the time for retirement of a structure than was the fatigue life gage, although no estimate of the damage incurred can be obtained prior to crack detection. Author (GRA)

N73-18872* Hughes Aircraft Co., Culver City, Calif.
MECHANICAL COMPONENT SCREENING FOR SCANNER
J. L. Olson and W. J. Quinn *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 59-67 (For availability see N73-18866 09-31)
CSCL 20F

N73-18875* Aerospace Corp., San Bernardino, Calif.
FRANGIBLE GLASS CANISTERS
Richard Seifert *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 91-99 (For availability see N73-18866 09-31)
CSCL 14B

N73-18877* General Electric Co., Philadelphia, Pa.
RADIOMETER-DEPLOYMENT SUBSYSTEM
Kevin M. Speight *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 111-122 (For availability see N73-18866 09-31)
CSCL 14B

N73-18887* Hughes Aircraft Co., El Segundo, Calif.
FLEXIBLE SOLAR-ARRAY MECHANISM
Merlyn C. Olson *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 233-249 (For availability see N73-18866 09-31)
CSCL 14B

N73-18888* Lockheed Missiles and Space Co., Sunnyvale, Calif.
SCANNING MIRROR FOR INFRARED SENSORS
Richard H. Anderson and Sidney B. Bernstein *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 251-265 (For availability see N73-18866 09-31)
CSCL 20F

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-18465*# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
DEVELOPMENT OF A PLAN FOR AUTOMATING INTEGRATED CIRCUIT PROCESSING Final Report, 1 Mar. - 1 Dec. 1971
1 Dec. 1971 172 p refs
(Contract NAS8-26909)
(NASA-CR-124116) Avail: NTIS HC $10.75 CSCL 13H

The operations analysis and equipment evaluations pertinent to the design of an automated production facility capable of manufacturing beam-lead CMOS integrated circuits are reported. The overall plan shows approximate cost of major equipment, production rate and performance capability, flexibility, and special maintenance requirements. Direct computer control is compared with supervisory-mode operations. The plan is limited to wafer processing operations from the starting wafer to the finished beam-lead die after separation etching. The work already accomplished in implementing various automation schemes, and the type of equipment which can be found for instant automation are described. The plan is general, so that small shops or large production units can perhaps benefit. Examples of major types of automated processing machines are shown to illustrate the general concepts of automated wafer processing. Author

N73-18466*# Callery Chemical Co., Pa. Div. of Mine Safety Appliances Co.
DESIGN AND DEVELOPMENT OF DIBORANE SHIPPING CONTAINER. VOLUME 2, APPENDIX A: RECORD OF CONTACTS WITH DOT REGARDING SPECIAL PERMIT FOR 200-POUND DIBORANE SHIPPING CONTAINER Final Report, 7 Nov. 1968 - 18 Sep. 1972
18 Sep. 1972 94 p Prepared for JPL
(Contract NASw-1827)
(NASA-CR-130808) Avail: NTIS HC $6.75 CSCL 13D

Pertinent documents are reported of the correspondance with the Department of Transportation for obtaining and revising Special Permit no. 6522 for the shipment of diborane. The documents reported cover the period from 4 June 1971 to 22 September 1972. The design and performance of 200-pound diborane shipping containers are included along with the requests for permission to ship quantities less that 200 pounds, and less than 100 pounds. F.O.S.

N73-18467# Southwest Research Inst., San Antonio, Tex.
ENGINEERING CONTROL OF WELDING FUMES Interim Technical Report, 30 Jun. - 31 Dec. 1972
William J. Astleford Jan. 1973 74 p refs
(Contract HSM-99-72-76; SwRI Proj. 02-3439)
(ITR-1) Avail: NTIS HC $5.75

The objective of this study is to develop design criteria for local ventilation systems capable of reducing the concentration of contaminants in the breathing zone of a welder. Accordingly, the design, fabrication, and performance of welding ventilation systems were evaluated. Contaminant species and their concentration levels in welding and cutting fumes as a function of process variables were defined. The contaminants of interest were the predominant metallic components of the fume cloud. The fume sampling tests indicate a necessity to reduce the fume component concentration relative to carbon steel and stainless steel welding. J.M.M.

N73-18468*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NEW PUMPING SYSTEM FOR A 150-KILOVOLT NEUTRON GENERATOR TO REDUCE THE PRESENT TRITIUM HAZARD
R. Steinberg and D. L. Alger Oct. 1972 48 p refs Sponsored in part by Food and Drug Admin.
(NASA-TM-X-2650; DHEW(FDA)-73-8011; BRH/DEP-73-2) Avail: NTIS HC $3.00 CSCL 13K

A new vacuum package incorporating a titanium bulk sublimator/ion pump combination has been designed, built, and evaluated on a typical 150-kilovolt neutron generator. The sublimator/ion pump system has been in operation and has provided the following operating advantages: (1) over 95 percent of the tritium released from the target during deuteron bombardment is permanently buried in the sublimator chamber walls as titanium tritide; (2) a rapid pumpdown time of 30 minutes from atmosphere to 10 to the minus 7th power torr is obtained routinely; (3) the new vacuum system is able to handle large active gas loads because of its high pumping capacity; (4) neutron generator operating pressure may be regulated between 10 to the minus 7th power torr and 10 to the minus 5th power torr by adjusting the rate of sublimation; and (5) the intermittent sublimation permits optimum use of available titanium, thus increasing pump life. The system is extremely reliable and requires little maintenance over long periods of time. The total cost of the vacuum package is competitive with existing pumping systems for new machines. Author

N73-18469*# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
RELIABILITY IMPROVEMENT OF 1 MIL ALUMINUM WIRE BONDS FOR SEMICONDUCTORS, TECHNICAL PERFORMANCE SUMMARY Final Report
6 Dec. 1971 89 p refs
(Contract NAS8-26636)
(NASA-CR-124037) Avail: NTIS HC $6.50 CSCL 14D

The reliability of semiconductor devices as influenced by the reliability of wire bonds used in the assembly of the devices is investigated. The specific type of failure dealt with involves fracture of wire bonds as a result of repeated flexure of the wire at the heel of the bond when the devices are operated in an on-off mode. The mechanism of failure is one of induced fracture of the wire. To improve the reliability of a chosen transistor, one-mil diameter wires of aluminum with various alloy additions were studied using an accelerated fatigue testing machine. In addition, the electroprobe was used to study the metallurgy of the wires as to microstructure and kinetics of the growth of insoluble phases. Thermocompression and ultrasonic bonding techniques were also investigated. J.M.M.

N73-18470# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Flugtrieb und Schmierstoffe.
DEVELOPMENT OF SOME COMPOSITE LAYERS FOR DRY LUBRICATION OF JOURNAL BEARINGS IN ATMOSPHERE

AND/OR IN VACUUM AT LOADS UP TO 80 kp/cm2 AND 200 Rpm
W. Hellwig and G. Spengler 1972 24 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-69) Avail: NTIS HC $3.25; DFVLR Porz-Wahn: 8,80 DM

Untreated as well as phosphatized or in-situ MoS2 pretreated sliding surfaces are coated with MoS2 and MoS2/PTFE in order to lubricate journal bearings with dry lubrication layers in atmosphere and/or in vacuum. Life and number of friction are measured mainly at 20 kp/sq cm and correlated with results previously obtained. The effect of a protective film on coated bearing parts against atmospheric influences was investigated. Data for optimum solutions are given. Author

N73-18471*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CONTAMINATION AVOIDANCE DEVICES FOR POPPET-TYPE SHUTOFF VALVES
D. L. Endicott Jan. 1973 176 p refs
(Contract NAS3-14375)
(NASA-CR-121125; MDC-G4328) Avail: NTIS HC$11.00 CSCL 13K

The determination of the cycle life is reported of the seal closure of a typical poppet-type shutoff valve in an uncontaminated GH2 environment and then compared this component performance with simulated operation with GN2 and LN2 containing controlled amounts of AL2O3 contaminant particles. The original valve design was tested for contamination damage tolerance characteristics under full-flow and cyclic-operating conditions, redesigned to improve the damage tolerance to contaminants, and then retested. The redesigned valve was found to have acceptable tolerance characteristics under all full-flow conditions and cyclic operation with small (25-75 microns) particulate contamination. The tolerance characteristics of the valve under cyclic conditions with large (75-250 microns) particulate contamination was improved but was not found to be completely satisfactory.
Author

N73-18472*# General Dynamics Corp., Groton, Conn. Electric Boat Div.
DEVELOPMENT OF LOW-COST WELDING PROCEDURES FOR THICK SECTIONS OF HY-150 STEEL
P. M. Schmidt and R. S. Snow Dec. 1972 177 p refs
(Contract NAS3-12056)
(NASA-CR-120994) Avail: NTIS HC $11.00 CSCL 13H

Low cost welding procedures were developed for welding 6-inch thick HY-150 steel to be used in the manufacture of large diameter motor case Y rings and nozzle attachment flanges. An extensive investigation was made of the mechanical and metallurgical properties and fracture toughness of HY-150 base plate and welds made with manual shielded metal arc process and semi-automatic gas metal arc process in the flat position. Transverse tensiles, all-weld metal tensiles, Charpy V-notch specimens and edge notched bend specimens were tested in the course of the program. In addition metallographic studies and hardness tests were performed on the weld, weld HAZ and base metal. The results of the work performed indicate that both the shielded metal arc and gas metal arc processes are capable of producing consistently sound welds as determined by radiographic and ultrasonic inspection. In addition, the weld metal, deposited by each process was found to exhibit a good combination of strength and toughness such that the selection of a rolled and welded procedure for fabricating rocket motor case components would appear to be technically feasible.
Author

N73-18473*# Sperry Rand Corp., Huntsville, Ala.
A DEVICE FOR CONFIGURING MULTIPLE LEADS Patent Application
Paul W. Clemons, inventor (to NASA) Filed 2 Mar. 1973 20 p Sponsored by NASA
(NASA-Case-MFS-22133-1; US-Patent-Appl-SN-337487) Avail: NTIS HC $3.00 CSCL 13H

A device for simultaneously configuring multiple leads projected from a printed circuit affixed to a circuit board is described. The device is used to accurately and consistently bend projecting leads to preselected angles to facilitate mechanical coupling of the leads within a selected circuit. NASA

N73-18474*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN AUTOMATIC LIQUID INVENTORY COLLECTING AND DISPENSING UNIT Patent Application
John B. Hall, Jr. and Edwin F. Williams, inventors (to NASA) Filed 21 Feb. 1973 13 p
(NASA-Case-LAR-11071-1; US-Patent-Appl-SN-334349) Avail: NTIS HC $3.00 CSCL 13D

The invention provides means for automatically collecting waste liquids and for simultaneously feeding these liquids into water recovery processes. The invention includes first and second tanks with first and second two-way solenoid valves associated with each of the tanks. The first solenoid valve is connected to the liquid source and its associated tank so as to allow liquid to flow into the tank when the valve is in its normal position and to allow the liquid to flow out of the tank when the valve is in its actuated position. The invention also includes means for indicating which tank is being filled and which tank is being emptied, means for indicating the liquid level in each of the tanks, means of counting the number of times the first and second tanks are filled and means for making the unit operable in a near-zero gravity environment. NASA

N73-18475*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION, WEAR, AND TRANSFER OF CARBON AND GRAPHITE TO COPPER, CHROMIUM, AND ALUMINUM METAL SURFACES IN VACUUM
Donald H. Buckley Washington Mar. 1973 21 p refs
(NASA-TN-D-7206; E-7087) Avail: NTIS HC $3.00 CSCL 11H

Sliding friction experiments were conducted with amorphous and fully graphitized carbons sliding on copper and on films of chromium and aluminum on copper. Auger emission spectroscopy analysis was used to monitor carbon transfer to the metal surfaces. Friction and wear were also measured. Metal surfaces were examined both in the clean state and with normal oxides present. Results indicate that different metals have an important effect on friction, wear, and transfer characteristics. With amorphous carbon, the least chemically active metal gave the highest wear and amount of carbon transfer. Both forms of carbon gave lower friction and wear and lower transfer rates when in contact with clean, as opposed to oxide-covered, chromium surfaces. With copper, the reverse was true; cleaning was detrimental. Author

N73-18476*# Mechanical Technology, Inc., Latham, N.Y.
DEVELOPMENT OF A HIGH SPEED PARALLEL HYBRID BOOST BEARING
L. W. Winn and M. W. Eusepi Washington NASA Mar. 1973 66 p refs
(Contract NAS3-14399)
(NASA-CR-2226; MTI-72TR25) Avail: NTIS HC $3.00 CSCL 13I

The analysis, design, and testing of the hybrid boost bearing are discussed. The hybrid boost bearing consists of a fluid film bearing coupled in parallel with a rolling element bearing. This coupling arrangement makes use of the inherent advantages of both the fluid film and rolling element bearing and at the same time minimizes their disadvantages and limitations. The analytical optimization studies that lead to the final fluid film bearing design are reported. The bearing consisted of a centrifugally-pressurized planar fluid film thrust bearing with oil feed through the shaft center. An analysis of the test ball bearing is also presented. The experimental determination of the hybrid bearing characteristics obtained on the basis of individual bearing component tests and a combined hybrid bearing assembly is discussed and compared to the analytically determined performance characteristics. Author

N73-18477# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
TECHNICAL ACCEPTANCE OF A TYPE C 90 MB VIBRATION GENERATOR [RECEPTION TECHNIQUE D'UN ENSEMBLE GENERATEUR DE VIBRATIONS TYPE C 90 MB]
Rene Hazard 16 Oct. 1972 113 p In FRENCH
(Contract DTEN-511.094.51(CI.043.636))
(LRBA-PV-15/72/SEV) Avail: NTIS HC $7.75

The vibration simulator C 90 MB is described together with

subsystems. The acceptance test procedure is discussed in detail, and results are compared with specifications. This equipment was found to be of good quality. ESRO

N73-18478# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
ON THE PLANE CONTACT PROBLEM FOR A FRICTIONLESS ELASTIC LAYER
M. Ratwani and F. Erdogan (Lehigh Univ.) Mar. 1972 40 p refs
(Grant NSF GK-11977)
(WB-1/72) Avail: NTIS

The plane contact problem for an elastic layer lying on an elastic half space is considered. A compressive load is applied to the layer through a frictionless rigid stamp. It is assumed that the contact between the layer and the subspace is also frictionless and only compressive normal tractions can be transmitted through the interface. The width of the contact area along the layer subspace interface is therefore finite and unknown. The problem is formulated in terms of a system of singular intergral equations in which the unknown functions are the pressure between the stamp and the layer and that between the layer and the subspace. The problem first is solved for the special case of concentrated loads. Two typical stamp geometries, namely, a flat stamp with sharp corners and a curved stamp, are then investigated. In the case of the flat stamp the system of integral equations is homogeneous, and as a consequence the width of the contact area between the layer and the subspace turns out to be independent of the magnitude of the external load applied to the stamp. In the curved stamp problem, however, the size of this contact region is a function of the magnitude of the external load. Author (ESRO)

N73-18479# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE DESIGN OF COMBINED HYDROSTATIC AND DYNAMIC BEARINGS
O. B. Prikhodko and O. K. Makarenko 25 Oct. 1972 17 p refs Transl. into ENGLISH from Mashinovedenie (USSR), no. 3, 1971 p 87-91
(AD-752821; FTD-HT-23-961-72) Avail: NTIS CSCL 13/9

Hydrodynamic bearings offer lubrication only within a certain range of speeds, typically 15-20 meters per second relative displacement. Hydrostatic bearings provide lubrication at all speeds, but require auxiliary pressure apparatus. In addition, hydrodynamic effects frequently occur in hydrostatic bearings. The parameters of bearings can all be determined if the pressure is known at all points in the gap between the surfaces. A mathematical expression can be formulated for the laminar flow of a viscous fluid, but in the general case it is unsolvable, since the solution is statistically indeterminate. However, by applying both zero and nonzero boundary conditions, it is possible to develop expressions which can yield results. Author (GRA)

N73-18480# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EVALUATION OF THE DURABILITY OF PLASTIC BEARINGS
F. K. Lebedev 19 Oct. 1972 11 p refs Transl. into ENGLISH from Tr. Mashinostroitelnyi Inst. (Kurgan), no. 10, 1969 p 121-124
(AF Proj. 7343)
(AD-752820; FTD-HT-23-816-72) Avail: NTIS CSCL 13/9

A formula for evaluating the durability of plastic bearings was derived, based on fatigue wear theory and including friction, elasticity, strength, and pressure factors. Author (GRA)

N73-18481# Trans-Sonics, Inc., Burlington, Mass.
SURVEY OF WEAR PROCESSES AND THE PARTICLES FROM WEAR BY MEANS OF A FERROGRAPH Final Report
Vernon C. Westcott, R. W. Wright, and G. P. Succi Oct. 1972 106 p refs
(Contract N00014-72-C-0278; NR Proj. 229-005)
(AD-753251) Avail: NTIS CSCL 11/8

During the sliding or rolling of one metal part against another, tiny metallic particles are produced. If the metal parts are lubricated by oil or grease the particles produced are of such a size that they are suspended in the oil in a colloidal manner. If one of the two metallic parts is composed of steel or alloys of steel, the metal particles generated during the wear process exhibit magnetic properties. The Ferrograph is an instrument which precipitates out these particles and deposits them on a transparent substrate. The particle sizes grade continuously along the substrate so that it is possible to examine individual particles in detail without interference from a random pile of other particles. This report surveys some of the findings about wearing systems and in large part is concerned with the correspondence between particle type and the class of mechanical part wearing. Author (GRA)

N73-18482# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON EQUATIONS OF THE ROLLING OF AN ELASTIC TIRE
V. S. Gozdek 13 Oct. 1972 20 p refs Transl. into ENGLISH from Uch. Zap. Tsagi (USSR), v. 1, no. 4, 1970 p 84-91
(AF Proj. 1369)
(AD-752697; FTD-MT-24-789-72) Avail: NTIS CSCL 13/6

Analysis of the relationships between the motion of a rolling wheel with an elastic tire and the forces exerted on the tire by the ground, assuming the absence of slippage between the tire and the ground surface. It is demonstrated that the rolling process can be represented by the solution of a boundary value problem for the stress state of the tire without introducing supplementary relationships among the tires' strain components. Author (GRA)

N73-18483# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE CHANGE IN THICKNESS OF THE OIL LAYER IN OIL FILM BEARINGS IN SHEET MILLS
S. I. Bolshakova and V. I. Bolshakov 19 Oct. 1972 15 p refs Transl. into ENGLISH from Teor. Mekhanizmov i Mashin Resp. Mezhved. Nauchn.-Teckhn. Sb. (USSR), no. 9, 1970 p 40-44
(AD-752688; FTD-HT-23-859-72) Avail: NTIS CSCL 11/8

An equation was formulated for the movement of the oil film bearing with respect to the bushing to account for the inertial force, viscous force of the liquid and the load lifting force exerted by the bearing with the movement of the pin. The equation is used as a basis for plotting an electronic model for the oil film bearing to study the behavior of rolling mill bearings, their effect on the nature of the load applied to the drive and the value of strain in the mill stand. Author (GRA)

N73-18484# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VOLUMETRIC AND MECHANICAL PROPERTIES OF PHTHALOCYANINE LUBRICANTS
R. I. Kobzova, Z. D. Egorova, E. E. Pisarevskaya, and V. G. Dmitrieva 27 Oct. 1972 11 p refs Transl. into ENGLISH from Neftepererabotka Neftekhim. (Moscow), no. 6, 1971 p 13-16
(AD-752827; FTD-HT-23-1034-72) Avail: NTIS CSCL 11/8

Comparative data on limiting stabilities and thickening properties of phthalocyanine (I) lubricants in different dispersion media are given. Author (GRA)

N73-18485# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACCELERATED RELIABILITY TESTS BY THE CONTINUOUS LOADING METHOD
D. F. Gugushvili and O. M. Namicheishvili 23 Oct. 1972 13 p refs Transl. into ENGLISH from Akad. Nauk Gruzin. SSR, Tiflis. Soobshch. (USSR), v. 61, 1971 p 45-48
(AD-752689; FTD-HT-23-899-72) Avail: NTIS CSCL 09/5

Some of the theoretical aspects of the continuous loading method for accelerated reliability tests of circuit components are described. This method makes it possible to calculate the average trouble free service life of a component operating at rated work performance. Author (GRA)

N73-18486# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SAFE APPLICATION OF A NEW LUBRICANT SEALANT
N. G. Trifel, P. V. Kutsyn, and A. G. Nagieva 19 Oct. 1972 12 p Transl. into ENGLISH from Tr. Vses. Neft. Nauch. Issled. Inst. Tekh. Bezop. (Moscow), no. 18, 1969 p 146-149
(AF Proj. 7343)

(AD-752825; FTD-HT-23-786-72) Avail: NTIS CSCL 11/1

For hermetic sealing of threaded joints of drive pipes, a lubricant sealant US-1 consists of an epoxy resin, a congealer (vat residue of hexamethylenediamine), and a filler. The epoxy resins have chemical stability, high adhesion, and anticorrosive and dielectric properties, but these resins and congealers are toxic. During cleaning and degreasing of the thread with solvents, the concentration of their vapors exceeds the permissible limits. Author (GRA)

N73-18487# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEM OF THE TEMPERATURE FIELD OF A LUBRICATING LAYER IN THRUST SLIDE BEARINGS

M. E. Podolskii 27 Oct. 1972 28 p refs Transl. into ENGLISH from the book "Razvitie Gidrodinamicheskoi Teorii" Moscow, Izd-vo Nauka, 1970 p 89-104

(AF Proj. 7343)

(AD-753044; FTD-MT-24-609-72) Avail: NTIS CSCL 11/8

Examined in the article are some problems connected with the study on the interaction of velocity and temperature fields in the lubricating layer of thrust slides bearings. Influence on the temperature field of the side outflow of lubrication, the inconstancy of the velocity over the thickness of the layer and the interconnection between the velocity and temperature fields is analyzed, taking into account the variability of the viscosity along the length and thickness of lubricating layer. GRA

N73-18488# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEFECTS IN PRODUCTS DURING HIGH-SPEED EXTRUSION

P. P. Antsiporovich 3 Nov. 1972 8 p Transl. into ENGLISH from the publ. "Voprosy Prochnosti i Plastichnosti Metallov" Minsk, 1970 p 64-66

(AF Proj. 7351)

(AD-752867; FTD-HT-23-1615-72) Avail: NTIS CSCL 13/8

Results are presented from analysis of deformation of defects with direct cold high speed extrusion. The reason for the appearance of tears during deformation is the great force of inertia. The appearance of necks at the ends of products results from movement of the elastic compression impulse through the blank. GRA

N73-18489# Whittenburg, Vaughn Associates, Inc., Landover, Md. Oceanautics Div.

HUMAN FACTORS GUIDE FOR THE DESIGN OF DIVER-OPERATED HAND AND POWER TOOLS Final Technical Report, Oct. 1969 - Jun. 1972

Birger G. Andersen Jul. 1972 151 p refs

(Contract N00014-70-C-0070; NR Proj. 196-095)

(AD-753262; OI-TR-72/2-SK) Avail: NTIS CSCL 13/9

The report describes the results of a research study directed toward expanding the available data base of man's ability to work underwater, by providing human factors data on man's requirements and capabilities as an undersea worker. The report is a basic human factors criteria guide for the design of diver-operated tools and work systems. Data included were developed and compiled through evaluation of operational diver work tasks, in-the-field observation of diving operations, and survey and review of existing human factors research data. The document is organized into five major sections: Anthropometry and biomechanics; body restraint and tethering systems; underwater visibility; control/display criteria; and human engineering considerations for specific underwater tools. The Appendix contains detailed specifications for a selected number of frequently used power tools. Author (GRA)

N73-18490# Rensselaer Polytechnic Inst., Troy, N.Y.

FATIGUE BEHAVIOR OF THIN SOLID FILMS INDUCED BY A MOVING SURFACE LOAD Final Report, Jan. 1965 - Dec. 1966

Richard A. Mollicone Wright-Patterson AFB, Ohio AFML Feb. 1972 59 p refs

(Contract AF 33(615)-3378; AF Proj. 7342)

(AD-753411; AFML-TR-71-171) Avail: NTIS CSCL 11/8

The purpose of this experimental study is to determine if a fatigue type failure and an endurance limit can be observed when a thin surface film is subjected to a normal load moving at a constant speed. Author (GRA)

N73-18491# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

GLUING ALUMINUM ALLOY PARTS (SELECTED PORTIONS)

22 Nov. 1972 24 p Transl. into ENGLISH from the monograph "Osnovy Konstruirovaniya v Samoletostroenii" Moscow, 1971 p 171-184

(AD-753513; FTD-MT-24-1073-72) Avail: NTIS CSCL 13/8

Given are methods for designing and calculating typical elements of aircraft construction, such as beams, joint units, rivet, welded, glue and gluewelded connections. Taken into account are the basic requirements of aviation construction; namely, minimum weight and sufficient durability. Author (GRA)

N73-18492# General Motors Corp., Indianapolis, Ind. Diesel Allison Div.

LIGHTWEIGHT GEARBOX DEVELOPMENT FOR PROPELLER GEARBOX SYSTEM APPLICATIONS POTENTIAL COATINGS FOR TITANIUM ALLOY GEARS Final Report

Richard A. Hirsch Dec. 1972 119 p refs

(Contract F33615-70-C-1383)

(AD-753417; DDAD-EDR-7326; AFAPL-TR-72-90) Avail: NTIS CSCL 13/9

The objective of the program is to develop the capability of titanium gears to sustain 126 million repetitive stress cycles at a surface contact stress of 132,000 psi based on steel modulus of elasticity. The achievement of this goal will make titanium gears significantly attractive for the 1975 time period. Optimum titanium material composition was selected to provide desirable strength properties and compatibility to the selected surface coating system. Plated surface coatings, bonding techniques, heat treat processes, and surface lubrication coatings were investigated to provide an optimum system which would withstand the scheduled test requirements. Iron-plated coatings which were diffusion bonded to the titanium core and then carbonitrided to provide surface hardness were selected as the most promising system. Author (GRA)

N73-18493# Mechanical Technology, Inc., Latham, N.Y.

CERAMIC GAS BEARING MATERIAL EVALUATION Technical Report, 7 Apr. - 9 Sep. 1972

John T. McCabe, Peter R. Albrecht, and Eugene F. Finkin 9 Sep. 1972 28 p

(Contract N00014-72-C-0083)

(AD-753018; MTI-72TR40) Avail: NTIS CSCL 13/9

Flat washer specimens were experimentally tested under conditions simulating start-stop and continuous rubbing contact of a gas-lubricated thrust bearing. Minimum surface damage with a constant and low value of the friction coefficient were criteria for judging superior performance. The materials tested consisted of conventional plasma-sprayed substrates (used as reference materials), solid silicon nitride, beryllium oxide, and beryllium both coated and uncoated. Author (GRA)

N73-18494# Honeywell, Inc., Bloomington, Minn. Corporate Research Center.

FUNDAMENTAL RESEARCH ON MACHINING OF BRITTLE MATERIALS Final Report

Dec. 1972 24 p refs

(Contract N00014-69-C-0123)

(AD-753027; Z9532-8001) Avail: NTIS CSCL 13/8

The report reviews the nature of the surface produced by semi-finish ceramic machining operations. The depth of plastic deformation in single crystals is a function of their hardness. The relative extent of plastic burnishing and brittle fracture in polycrystalline ceramics is a function of their hardness, microstructure and input strength. Direct measurements of grinding forces shows a correlation with the fracture toughness parameters. The consequences of ceramic machining on physical properties, particularly magnetic properties, is reviewed. The deterioration in performance due to ceramic machining is related to the thickness of the sample. All magnetic properties are restored athermally by annealing. These observations are interpreted in terms of stress gradients due to plastic flow at the surface and stress induced phase changes. Author (GRA)

N73-18495# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TWO-DIMENSIONAL PROBLEM OF THE HYDRODYNAMIC THEORY ON LUBRICATION OF A THRUST BEARING WITH CONSIDERATION OF ATTRACTING FORCES IN A LAYER
M. E. Podolskii 27 Oct. 1972 20 p refs Transl. into ENGLISH from Tr. Korablestroitolnyi Inst. (Leningrad), no. 68, 1969 p 165-174
(AF Proj. 7343)
(AD-753030; FTD-HT-23-554-72) Avail: NTIS CSCL 11/8

The article deals with the two dimensional motion of a viscous incompressible fluid with a variable coefficient of viscosity in thrust bearing. The problem was solved by the method of successive approximations by means of a computer. It was assumed that the temperature of the lubricant changes according to a parabolic law in a direction perpendicular to the moving wall, the temperature of this wall is constant, while the heat emission of the stationary inclined wall of the thrust bearing is equal to zero. The calculation results that are presented for some particular cases of the work of the thrust bearing show that as a result of the influence of the variability of the viscosity of the lubricant, the value of the supporting force of the thrust bearing decreases. When the walls of the thrust bearing are parallel, an attractive hydrodynamic force originates. GRA

N73-18496# Solar, San Diego, Calif.
SOLAR 10 kW TURBO-ALTERNATOR BEARING STUDY AND 6000-HOUR TEST PROGRAM Final Technical Report
Thomas P. Psichogios and Peter Truman Sep. 1972 159 p
(Contract DAAK02-70-C-0361)
(AD-752895; ER-2418) Avail: NTIS CSCL 13/9

The report describes an analytical study program and a successful endurance test conducted on the 93,500 rpm bearings used to support the rotor assembly of the Solar 10 kW Turbo-Alternator Generator Set currently nearing the end of a development program under contract to the U.S. Army. The analytical study includes an evaluation of possible refinements to the bearing design and an investigation of fluid film bearings. GRA

N73-18497# Florida State Univ., Tallahassee. Dept. of Statistics.
NONSTATIONARY SHOCK MODELS
Mohamed Abdul-Hameed and Frank Proschan Nov. 1972 34 p refs
(Grant AF-AFOSR-2058-71; AF Proj. 9749)
(AD-753117; FSI-Statistics-M243; AFOSR-72-2319TR; TR-6) Avail: NTIS CSCL 14/4

The paper extends results obtained by Esary, Marshall, and Proschan (1970) in (Shock models and wear processes), Florida State University Statistics Report M231R. Life distribution properties of a device subject to shocks governed by a nonhomogeneous Poisson process are related to corresponding properties of the probability of failing after experiencing a given number of shocks. Physically motivated models are analyzed in which shocks cause damage to a set of components, the damages accumulate additively, and when the accumulated damage exceeds a critical threshold (possibly random) for any of the components, the device fails. Bounds are obtained on the mean life of the device. Author (GRA)

N73-18498# Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.
SEVEN YEARS TROPICAL EXPOSURE OF FINISHING SYSTEMS FOR ALUMINUM AND MAGNESIUM Progress Report
Melvin H. Sandler Nov. 1972 53 p refs
(DA Proj. 1T0-62105-A-329)
(AD-752907; CCL-319) Avail: NTIS CSCL 11/3

The report covers a study of the corrosion resistance provided by specification finishing systems to aluminum and magnesium exposed in a tropical environment. The systems include chemical, anodic, and wash primer metal pretreatments, primers specified for these metals in Military Standard No. 171 (Finishing of Metal and Wood Surfaces); several other specification primers that have been used for these metals; and an experimental epoxy primer. Finish coats included specification lustreless, semi-gloss, and gloss alkyd resin enamels and a gloss polyamide-epoxy enamel. Seven years exposure shows finishing systems are available for the protection of aluminum and magnesium. Author (GRA)

N73-18499# Rhode Island Univ., Kingston. Dept. of Pharmacognosy.
CERAMIC MATERIALS FOR HIGH TEMPERATURE GAS BEARINGS Annual Technical Report. 1 Sep. 1971 - 1 Sep. 1972
P. J. Gielisse, M. P. Wilson, V. N. Borase, L. K. Heung, and A. J. Kiehle 1 Sep. 1972 149 p refs
(Contract N00014-68-A-0215-0008)
(AD-753858; URI-9804-4046) Avail: NTIS CSCL 13/9

Hot pressed Si3N4 has been evaluated for application as a high temperature gas bearing material. The results of two types of thrust washer tests, a continuous run and start-stop test, in terms of coefficient of friction, and mode of wear are reported. Author (GRA)

N73-18500# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF RESIDUES FROM THE CENTRIFUGING OF ADDITIVES
I. I. Namazov, Ya. I. Eminbeili, R. G. Gassanov, and Yu. G. Rzaev 23 Oct. 1972 13 p Transl. into ENGLISH from Azerb. Neft. Khoz. (Baku), no. 9, 1970 p 36-38
(AF Proj. 7343)
(AD-751945; FTD-HT-23-903-72) Avail: NTIS CSCL 11/8

The formation of residues is due to the excess of BaO used to prepare the lubricant additives. Barium is recovered by extracting with C6H 6 the cake obtained by centrifuging of additives. A residue obtained containing 57 to 62% Ba as BaO or CacO3. The latter is reused as a neutralizing agent for additive preparation, thus reducing the consumption of fresh Ba(OH)2. Author (GRA)

N73-18501# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMIZATION OF THE WORKING CHARACTERISTICS OF HYDROSTATIC SLIDING BEARINGS
F. Abdulhafez 9 Dec. 1972 23 p refs Transl. into ENGLISH from Maschinenbau Tech. (Berlin), v. 20, no. 3, 1971 p 140-145
(AF Proj. 7343)
(AD-753553; FTD-HT-23-1314-72) Avail: NTIS CSCL 13/9

The various aspects of optimum bearing design are discussed with references to other published works on the subject. An optimality criterion is derived and a permissible shift of 9% is introduced in the stiffness value. The significance of resilience and damping properties of the lubricating films in sliding bearings are indicated. From theoretical bases a nomograph is developed portraying the relationship between working characteristics, actual dimensions of bearing and properties of lubricant. An example is given to show how critical parameters can be calculated with the aid of the nomograph. Author (GRA)

N73-18883* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LIQUID PUMP FOR ASTRONAUT COOLING
Maurice A. Carson *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 181-189 (For availability see N73-18866 09-31) CSCL 13K

N73-18889* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MANIPULATOR TECHNOLOGY FOR THE SPACE SHUTTLE
E. Glenn Burroughs *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 267-274 (For availability see N73-18866 09-31) CSCL 13H

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-18502*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
LASER TRANSIT-TIME MEASUREMENTS BETWEEN

EARTH AND MOON WITH A TRANSPORTABLE SYSTEM
C. G. Lehr, S. J. Criswell, J. P. Ouellette, P. W. Sozanski, J. D. Mulholland, and P. J. Shelus Jan. 1973 4 p refs
(Contract NASw-2014)
(NASA-CR-130986; Rept-212-092) Avail: NTIS HC $3.00 CSCL 20E

A high radiance, pulsed laser system with a transportable transmitting unit was used to measure the transit times of 25 ns, 10 joule, and 530 nm pulses from earth to the Apollo 15 retroreflector on the moon and back. Author

N73-18503# Defence Research Establishment Valcartier (Quebec). Defense Research Board.
THE PREDICTION OF THERMODYNAMIC DAMAGE OF MATERIALS IRRADIATED BY INTENSE LASER BEAMS
C. M. Leech Nov. 1972 31 p refs
(DREV-R-672/72) Avail: NTIS HC $3.75

The thermodynamic behavior of target materials, irradiated by laser beams, has been mathematically modelled. Spherical and cylindrical domains, simulating core and surface irradiation, were examined. The thermodynamic phase changes have been considered, so that any latent heats of fusion and vaporization are included in the modelling. The model has been used to predict the damage volumes for aluminum, beryllium, iron and uranium targets irradiated by a single high energy pulse. Author

N73-18504# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
AN X-BAND RUTILE TRAVELING WAVE MASER
Erik L. Kollberg Oct. 1971 15 p refs
(Rept-107) Avail: NTIS HC $3.00

The characteristics of a traveling wave maser amplifier for radio astronomy and deep space communication experiments are discussed. A technique for building traveling wave maser amplifiers for the frequency ranges of 7.5 to 8.3 GHz is described. A numerical analysis of the performance of the amplifiers is included. Author

N73-18505# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
ON THE DEVELOPMENT OF MILLIMETER-WAVE TRAVELING WAVE MASERS
Erik L. Kollberg Dec. 1971 16 p refs
(Rept-109) Avail: NTIS HC $3.00

Work done for the realization of a complete 20 to 25 GHz traveling wave maser is described. The final system is designed for use in large radio telescopes for satellite communication and radio astronomy. The system is composed of an amplifying unit, superconducting magnet, cooling system and input waveguides, and front end waveguide. Author

N73-18506# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
VELOCITY MEASUREMENTS IN BUBBLY TWO PHASE FLOWS USING LASER DOPPLER ANEMOMETRY, PART 2
W. E. R. Davies and J. I. Unger Jan. 1973 47 p refs Sponsored by AECL
(UTIAS-TN-185-Pt-2) Avail: NTIS HC $4.50

The application of the laser Doppler velocity measuring technique to both turbid and bubbly flow media is described. Two types of automatic frequency trackers were tested and their performance evaluated under a variety of flow conditions. A high frequency void fraction measuring instrument was developed using a capacity principle and is used to provide information on flow conditions. Full details on the electronics associated with the frequency tracking unit and the void fraction meter are included in the report. Author

N73-18507*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE BAPE 2 BALLOON-BORNE CO2
J. J. Degnan, H. E. Walker, C. J. Peruso, E. H. Johnson, B. J. Klein, and J. H. McElroy Jun. 1972 57 p
(NASA-TM-X-65946; X-524-72-212) Avail: NTIS HC $5.00 CSCL 20E

The systems and techniques which were utilized in the experiment to establish an air-to-ground CO2 laser heterodyne link are described along with the successes and problems encountered when the heterodyne receiver and laser transmitter package were removed from the controlled environment of the laboratory. Major topics discussed include: existing systems and the underlying principles involved in their operation; experimental techniques and optical alignment methods which were found to be useful; theoretical calculations of signal strengths expected under a variety of test conditions and in actual flight; and the experimental results including problems encountered and their possible solutions. Author

N73-18508*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHOD OF PRODUCING A STORAGE BULB FOR AN ATOMIC HYDROGEN MASER Patent Application
Hubert Erpenbach, inventor (to NASA) Filed 22 Dec. 1972 13 p
(Contract NAS7-100)
(NASA-Case-NPO-13050-1; US-Patent-Appl-SN-317567) Avail: NTIS HC $3.00 CSCL 20E

A storage bulb for an atomic hydrogen maser is produced by coating its internal surface with a solution containing both TFE and FEP particles. The solution is produced by mixing TFE in an aqueous dispersion with FEP in an aqueous dispersion, with distilled water. The solution is poured into the bulb to coat it uniformly so as to form a thin film of solution on the bulb's internal surface. After the excess solution is drained out of the bulb the solution in the bulb is dried to remove the water and most of the aqueous matter. The remaining solution is then cured by heating the bulb to a temperature of at least 380 C. NASA

N73-18509# Lockheed Missiles and Space Co., Palo Alto, Calif.
DIFFERENT THERMAL HEATING MODES DURING INTERACTION OF POWERFUL RADIATION FLUXES WITH A MATERIAL
P. P. Volosevich, S. P. Kurdiumov, and E. I. Levanov [1972] 8 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 5, 1972 p 41-48
Avail: NTIS HC $3.00; Natl. Translations Center, John Crerar Library, Chicago, Ill. 60616

The gas dynamic and thermal processes originating because of the interaction of a powerful flux of laser radiation with a material are investigated. Those fluxes for which the sublimation energy can be neglected as compared with the thermal and kinetic energies of the vapors being formed are considered. The electron heat conduction is taken into account in addition to the hydrodynamic dissipation. The properties of various modes of temperature wave propagation in a moving medium are studied. The main attention is paid to the case of an infinite absorption coefficient. Author

N73-18510# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS Technical Report, Jul. - Sep. 1972
Stuart G. Hibben 27 Nov. 1972 130 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-3)
(AD-753098; AFOSR-72-2403TR; Rept-9) Avail: NTIS CSCL 20/5

Contents: Solid state lasers; Liquid lasers; Gas lasers; Chemical lasers; UV lasers; Components; Nonlinear optics; Spectroscopy of laser materials; Ultrashort pulse generation; Crystal growing; General laser theory; Biological effects; Communications; Computer technology; Holography; Instrumentation and measurements; Materials processing; Plasma generation and diagnostics. Author (GRA)

N73-18511# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Optical Physics Lab.
ATMOSPHERIC TRANSMITTANCE, 7-30 MICROMETERS: ATTENUATION OF CO2 LASER RADIATION Interim Report
R. A. McClatchey and J. E. A. Selby 12 Oct. 1972 78 p refs
(AF Proj. 7670)
(AD-753076; AFCRL-72-0611; ERP-419) Avail: NTIS CSCL 04/1

High resolution transmittance curves are presented for the spectral region 320-1400 wavenumbers. These spectra are useful as a guide for selecting laser wavelengths for atmospheric propagation studies in this spectral region. In addition, this report provides specific information concerning the attenuation

coefficients of 41 CO2 rotational laser lines in the 10.4 micrometer band system (v3 to v1). Charts for predicting the atmospheric attenuation of the CO2 laser lines are provided for each of five climatological model atmospheres and two haze models. The current report extends the work presented in two earlier reports on (1) CO laser attenuation in the 1400-2120/cm (4.72-7.14 micrometers) region: AFCRL-71-0370 and (2) HF and DF laser attenuation in the 2120-3740/cm (2.67-4.72 micrometers) region: AFCRL-72-0312. This report, when combined with the two previous reports described above, provides synthetic spectra for the entire region from 2.67-31.25 micrometers.
Author (GRA)

N73-18512# Coors Porcelain Co., Golden, Colo.
R AND D ON THE APPLICATION OF POLYCRYSTALLINE ZINC SELENIDE AND CADMIUM TELLURIDE TO HIGH ENERGY IR LASER WINDOWS Report for 1 Jul. 1971 - 12 Jun. 1972
M. W. Benecke, C. R. Porter, and D. W. Roy Wright-Patterson AFB, Ohio AFML Jul. 1972 143 p refs
(Contract F33615-71-C-1863; AF Proj. 317)
(AD-753068; AFML-TR-72-177) Avail: NTIS CSCL 20/5

The optical absorption of previously available polycrystalline zinc selenide and cadmium telluride was too extensive to permit the use of these materials in high energy laser windows. The approach used in the program was to make polycrystalline windows by hot-pressing under optimum conditions, making use of starting materials of ordinary purity and stoichiometry which were currently available on a commercial basis. Many ZnSe pressings and a few CdTe pressings were made which possessed essentially theoretical transmittance. Absorption coefficients as low as 0.023 cm/1 and 0.33 cm/1 were obtained in ZnSe and CdTe respectively. ZnSe powder ingots were the best starting materials. Absorption at 9 micrometer was a persistent problem in both materials. Although extensive analytical testing was carried out and optical transmission and electrical measurements were made as appropriate, the mechanisms responsible for the absorption were not fully explained. Author

N73-18513# Purdue Univ., Lafayette, Ind. Project Sound Headquarters.
THE USE OF THE LASER DOPPLER VELOCIMETER FOR FLOW MEASUREMENTS
W. H. Stevenson and H. D. Thompson Nov. 1972 553 p refs Proc. of Workshop held at Lafayette, Ind., 9-10 Mar. 1972
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-753243) Avail: NTIS CSCL 20/4

The report contains the proceedings of the Workshop on The Use of The Laser Doppler Velocimeter For Flow Measurements held on March 9-10, 1972 at Purdue University. This workshop was co-sponsored by Project SQUID and the U.S. Army Missile Command, Huntsville, Alabama. The workshop participants included representatives from universities, industry, government and abroad. Author (GRA)

N73-18514# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
[PROGRESS ON FREQUENCY SPECTRUM EXTENSION AND IMPROVED TECHNIQUES IN MICROWAVE SPECTRUM] Consolidated Quarterly Report, 1 Oct. - 31 Dec. 1971
R. L. Arnold, P. W. Chen, C. H. Durney, O. P. Gandhi, and R. W. Grow 31 Dec. 1971 88 p refs
(Contracts N00014-69-C-0345; N00014-67-A-0325-0005; Grants DA-ARO(D)31-124-71-G111; NSF GK-16574; NR Proj. 373-740)
(AD-753266; MDL-Q39; UTEC-MD-72-139) Avail: NTIS CSCL 20/5

The purpose of the research activity reported herein is to extend the useful frequency spectrum into the range from microwave frequencies to optical frequencies and to improve existing devices and techniques in the microwave spectrum. At present this objective is being pursued by studies of electron beam devices, quantum electronic devices, plasmas, and solid-state devices. Author (GRA)

N73-18515# Radio Corp. of America, Princeton, N.J.
EFFECTS OF TURBULENCE INSTABILITIES ON LASER PROPAGATION Quarterly Technical Report, 19 Jun. - 18 Sep. 1972
David A. DeWolf Griffiss AFB, N. Y. RADC Oct. 1972 35 p refs
(Contract F30602-72-C-0486; ARPA Order 1279)
(AD-753401; PRRL-72-CR-45; RADC-TR-72-308) Avail: NTIS CSCL 20/6

Some remarks are presented on Furutsu's recent theoretical analysis of irradiance scintillation and the author defines and computes useful criteria for the resolution of point features on an illuminated target in turbulent air. The results are related to the work on focal-spot areas. The coefficient of the log-amplitude variance in the saturation regime is computed. Finally, the work on power spectra of angle-of-arrival fluctuations is expanded to include a simple interferometer. Two physical cases, simply related to the ray formulas, appear to apply in most practical situations. Author (GRA)

N73-18516# Stanford Univ., Calif. Microwave Lab.
DISPERSIVE EXPLANATION OF THE SPECTRAL BEHAVIOR OF RUNGE'S MODE-LOCKED DYE LASER
A. E. Siegman 16 Mar. 1972 5 p refs Repr. from Opt. Commun. (Amsterdam), v. 5, no. 3, Jun. 1972 p 200-201
(Contract F44620-71-C-0053; AF Proj. 9751)
(AD-753408; ML-2036; AFOSR-72-2413TR) Avail: NTIS CSCL 20/5

An alternative explanation is offered for the unusual spectral behavior seen by Runge in a continuous intra-pump-cavity mode-locked dye laser. The behavior is attributed to the dispersive or group-velocity effects of Ne 1s metastable atoms in the pumping laser tube. Author (GRA)

N73-18517# Army Electronics Command, Fort Monmouth, N.J.
TUNABLE PARAMETRIC OSCILLATORS BETWEEN 1.0 MICROMETERS - 5.0 MICROMETERS
Gregory R. Osche Oct. 1972 26 p refs
(DA Proj. 1S6-62603-A-056)
(AD-753347; ECOM-4038) Avail: NTIS CSCL 20/5

A general discussion of the practical aspects of continuously tunable parametric down-conversion techniques are discussed. The tuning range of interest is the 1.0 micrometer spectrum, suggesting the use of the 1.06 micrometer neodymium laser line as a pump. Crystal types, oscillator configurations and design parameters are discussed in a semi-quantitative fashion intended for use by systems engineers and analysts.
Author (GRA)

N73-18518# Northrop Corp., Hawthorne, Calif. Research and Technology Center.
APPLICATION OF HOLOGRAPHIC STEREOGRAMS TO PHOTOGRAPHIC INTERPRETATION Final Report
John T. McCrickerd Nov. 1972 75 p refs
(Contract F30602-71-C-0176)
(AD-753167; NRTC-72-1R; RADC-TR-72-282) Avail: NTIS CSCL 14/5

Techniques were developed for displaying 3-D images of terrain photography, in an attempt to increase the effectiveness of reconnaissance interpretation by trained and untrained personnel. Two holographic stereogram methods were developed. The first method provides a multi-viewpoint stereogram which appears similar to a classical hologram, but is synthesized from a multitude of component photographs using a ray reconstruction approach. This stereogram is made by an involved process which includes rectification of a number of aerial photos, and subsequent holographic recording of the photos. The multi-viewpoint stereogram is useful for viewing scenes in which features are obscured when viewed from certain directions. The second method developed provides a 3-D holographic stereo-photo-pair display viewable in incoherent illumination. The two-viewpoint stereogram is produced by multiplexing right and left eye views on a focused-image hologram plate. Production is relatively simple, but depends upon efficient phase-type holographic material with good clarity. Major advantages of this stereo-pair display over other devices, such as stereoscopes, are the inherent ease of viewing and the possibility of viewing without any auxiliary equipment in improvised illumination. Author (GRA)

N73-18519# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
STUDY OF EFFECTS OF HIGH ENERGY RADIATIONS IN LASER MATERIALS Final Report
Chihiro Kikuchi Dec. 1972 30 p refs
(Contract N00014-67-A-0181-0006)
(AD-753534; Rept-08769-F) Avail: NTIS CSCL 20/5

The objective of the program was to investigate the effects of high energy radiations, both from the standpoint of laser action and for the purpose of obtaining information about laser active centers. Efforts were concentrated on CaWO4:Nd, charge compensated by Nb. Author (GRA)

N73-18520# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACADEMY OF SCIENCES OF THE USSR, PHYSICS INSTITUTE, TRANSACTIONS, NUMBERS 33, 67, 1972: SELECTED ARTICLES
N. N. Sobolev and V. V. Sokovikov 13 Oct. 1972 92 p refs
Transl. into ENGLISH from Tr. Akad. Nauk SSSR, Fiz. Inst. (Moscow), no. 67, 1972 p 1-61, no. 33 p 1-63
(AD-753559; FTD-MT-24-1459-72) Avail: NTIS CSCL 20/5

A survey of the investigations of a mechanism for the formation of an inverse population of oscillatory levels in the gas-discharge CO-lasers is presented. A major discussion concerns a presentation of the presently available theoretical and experimental data on the probabilities of oscillatory transitions in molecules. Works are discussed in detail in which calculations of the population of oscillatory levels in a CO-laser are given. Analysis of the indicated works leads to the conclusion about the correctness of the hypothesis in accordance with which the pumping of energy into the oscillatory degrees of freedom of molecules of CO occurs by electron impact and the population of the high-lying levels. Author (GRA)

N73-18521# University of Southern Calif., Los Angeles.
[HIGH POWER OUTPUT FROM CARBON DIOXIDE LASER, INCLUDING EFFECTS OF HIGHER ORDER TRANSVERSE AND LONGITUDINAL MODE EXCITATION] Final Technical Report, 30 Jun. 1971 - 30 Sep. 1972
William H. Louisell 20 Nov. 1972 35 p refs
(Contract DAAH01-71-C-1476)
(AD-753402) Avail: NTIS CSCL 07/4

The report describes research to obtain higher power output from CO2 lasers. This involved the study of the effect of higher order transverse and longitudinal mode excitation. Author (GRA)

N73-18522# Northrop Corp., Hawthorne, Calif. Laser Technology Labs.
UV GAS LASER STUDIES Semiannual Technical Report
Nov. 1972 32 p
(Contract N00014-72-C-0456; ARPA Order 1807)
(AD-753483; NRTC-72-14R) Avail: NTIS CSCL 20/5

A series of spectral measurements were carried out to demonstrate the feasibility of achieving stimulated emission in the vacuum ultraviolet using molecular xenon gas excited by a relativistic electron beam from a Febetron 705. Both longitudinal and transverse excitation schemes were used with gas pressures up to 30 atmospheres. The xenon emission spectrum at 3 atm consisted of a 150A wide band centered around 1750A. At higher pressures (20 atm) indication of a preferential intensity build up at several parts of the spectrum was recognizable over the broad continuum. This preferential build up disappeared when one of the cavity mirrors was taken out. Since no significant line narrowing was observed, the conclusion from the spectral studies using the Febetron 705 is that the evidence of stimulated emission in molecular xenon is at best marginal.
Author (GRA)

N73-18523# United Aircraft Corp., East Hartford, Conn. Research Labs.
HIGH POWER CO2 LASER DEVICES Interim Report, 22 Feb. - 30 Aug. 1972
Michael L. Skolnick, Peter P. Chenausky, Robert J. Freiberg, and Carl J. Buczek Dec. 1972 54 p refs
(Contract DAAB07-72-C-0124; DA Proj. 1S6-62703-A-056)
(AD-753605; UARL-L921316-7; ECOM-0124-1) Avail: NTIS CSCL 20/5

The report describes the investigations of frequency stable Q-switched CO2 laser oscillators. The characteristics of both free-running and injection-locked pulsed lasers are described. Optical heterodyne measurements of the frequency stability of the sources are presented. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-18524# National Lending Library for Science and Technology, Boston Spa (England).
THE QUALITY OF THE ANALYTICAL CONTROL OF THE PURIFICATION OF TITANIUM TETRACHLORIDE
V. I. Starshenko, M. P. Volynskaya, and G. N. Lebedev Nov. 1972 11 p refs Transl. into ENGLISH from Sb. Tr. Vses. Nauchn.-Issled. Proektn. Titana (USSR), v. 6, 1970 p 54-61
(NLL-RTS-7725) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.00; 3 NLL photocopy coupons

Analyses of impurities in titanium tetrachloride by the use of infrared spectroscopy, emission spectra, and various chemical methods are discussed. Infrared spectroscopy makes it possible to determine the molecular formulas of the impurities. The total content of the impurities is determined by emission spectroscopy and chemical reactions. Tables of data are presented to show: (1) molecular formulas of impurities determined by infrared spectroscopy, (2) sensitivity limits for determining elements by emission and chemical methods, (3) estimates of the total content of elements, and (4) influence of impurities in titanium tetrachloride on the increase in the hardness of the spongy titanous mass. Author

N73-18525*# Grambling Coll., La. Dept. of Physics.
TIME EXPOSURE STUDIES ON STRESS CORROSION CRACKING OF ALUMINUM 2014-T6, ALUMINUM 7075-T651, AND TITANIUM 6Al-4V Annual Report, 1 Jun. 1971 - Jun. 1972
Jethro Terrell 24 Jul. 1972 32 p refs
(Grant NGR-19-011-009)
Avail: NTIS HC $3.75 CSCL 11F

The effect of a constant applied stress in crack initiation of aluminum 2014-T6, 7075-T651 and titanium 6A1-4V has been investigated. Aluminum c-ring specimens (1-inch diameter) and u-band titanium samples were exposed continuously to a 3.5% NaCl solution (pH 6) and organic fluids of ethyl, methyl, and iso-propyl alcohol (reagent purity). Corrosive action was observed to begin during the first and second day of constant exposure as evidenced by accumulation of hydrogen bubbles on the surface of stressed aluminum samples. However, a similar observation was not noted for titanium stressed specimens. Results of this investigation seem to suggest that aluminum 2014-T6, aluminum 7075-T651 are susceptible to stress corrosion cracking in chloride solution (NaCl); while they (both alloys) seem to resist stress corrosion cracking in methyl alcohol, ethyl alcohol, iso-propyl alcohol, and demineralized distilled water. Titanium 6A1-4V showed some evidence of susceptibility to SCC in methanol, while no such susceptibility was exhibited in ethanol, iso-propyl alcohol and demineralized distilled water. Author

N73-18526*# Westinghouse Research Labs., Pittsburgh, Pa.
EUTECTIC EXPERIMENT DEVELOPMENT FOR SPACE PROCESSING Final Report, 1 Jan. - 1 Dec. 1972
R. H. Hopkins 14 Nov. 1972 58 p refs
(Contract NAS8-21905)
(NASA-CR-124103) Avail: NTIS HC $5.00 CSCL 11F

A ground base test plan and a specimen evaluation scheme have been developed for the aluminum-copper eutectic solidification experiment to be run in the M518 multipurpose electric furnace during the Skylab mission. Besides thermal and solidification studies a detailed description is given of the quantitative metallographic technique which is appropriate for characterizing eutectic structures. This method should prove a

key tool for evaluating specimen microstructure which is the most sensitive indicator of changes produced during solidification. It has been recommended that single grain pre-frozen eutectic specimens be used to simplify microstructural evaluation and to eliminate any porosity in the as-cast eutectic specimens. High purity (99.999%) materials from one supplier should be employed for all experiments. Laboratory studies indicate that porosity occurs in the MRC as-cast eutectic ingots but that this porosity can be eliminated by directional freezing. Chemical analysis shows that the MRC ingots are slightly Al rich and contain about .03% impurity. Because of the impurity content the lower cooldown rate (1.2 C/min) should be used for eutectic freezing if MRC material is used in the M518 furnace. Author

N73-18527*# California Univ., Los Angeles. School of Engineering and Applied Science.
DIRECTIONAL SOLIDIFICATION OF EUTECTIC COMPOSITES IN SPACE ENVIRONMENT Final Report
Alfred S. Yue Dec. 1972 53 p refs
(Contract NAS8-26402)
(NASA-CR-124094; UCLA-ENG-7296) Avail: NTIS HC $4.75 CSCL 11F

The Ni-Ni3Ta eutectic and a nickel-base alloy containing 30 wt pct Ta were solidified unidirectionally in an electron beam floating zone melting apparatus. It was found that the volume fraction of the Ni3Ta phase in the Ni-Ni3Ta eutectic mixture was increased from 7.6 to 36 volume pct in agreement with the theory as predicted. Tensile properties of the randomly solidified and unidirectionally solidified Ni-Ni3Ta eutectic were determined as function of solidification rate and temperature. It was found that the ultimate tensile strength decreased as both the test temperature and solidification rate increased. An elongation of 40 pct was obtained for a nickelbase alloy containing 30 wt at room temperature. This unusually large elongation was attributed to the superplastic behavior of the alloy. The critical currents versus the external fields at 2.5, 3.0, 3.5 and 4.2 deg for the unidirectionally solidified Pb-Sn eutectic were measured. The values of critical fields at zero critical currents were obtained by extrapolation. Author

N73-18528*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
HYDROGEN ADSORPTION AND DIFFUSION, AND SUBCRITICAL-CRACK GROWTH IN HIGH STRENGTH STEELS AND NICKEL BASE ALLOYS Annual Report, 1 Nov. 1971 - 31 Oct. 1972
R. P. Wei, K. Klier, G. W. Simmons, and E. Chornet Jan. 1973 87 p refs
(Grant NGR-39-007-067)
(NASA-CR-130979; AR-1) Avail: NTIS HC $6.50 CSCL 11F

Embrittlement, or the enhancement of crack growth by gaseous hydrogen in high strength alloys, is of primary interest in selecting alloys for various components in the space shuttle. Embrittlement is known to occur at hydrogen gas pressures ranging from fractions to several hundred atmospheres, and is most severe in the case of martensitic high strength steels. Kinetic information on subcritical crack growth in gaseous hydrogen is sparse at this time. Corroborative information on hydrogen adsorption and diffusion is inadequate to permit a clear determination of the rate controlling process and possible mechanism in hydrogen enhanced crack growth, and for estimating behavior over a range of temperatures and pressures. Therefore, coordinated studies of the kinetics of crack growth, and adsorption and diffusion of hydrogen, using identical materials, have been initiated. Comparable conditions of temperature and pressure will be used in the chemical and mechanical experiments. Inconel 718 alloy and 18Ni(200) maraging steel have been selected for these studies. Results from these studies are expected to provide not only a better understanding of the gaseous hydrogen embrittlement phenomenon itself, but also fundamental information on hydrogen adsorption and diffusion, and crack growth information that can be used directly for design. Author

N73-18529# Joint Publications Research Service, Arlington, Va.
SELECTED TRANSLATIONS ON METALLURGY
30 Jan. 1973 54 p refs Transl. into ENGLISH from Vliyaniye Predvaritelnoy Deformatsii na Svoystva Metallov i Splavov (Alma-Ata), no. 12, 1971 29 p
(JPRS-58097) Avail: NTIS HC $4.75

Articles are presented concerning the effects of preliminary deformation on superplasticity and other properties of metals and alloys. For individual titles, see N73-18530 through N73-18535.

N73-18530 Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF SUPERPLASTICITY AFTER PRELIMINARY DEFORMATION OF AN ALUMINUM-ZINC EUTECTOID
R. K. Aubakirova *In its* Selected Transl. on Met. 30 Oct. 1973 p 1-10 refs (For availability see N73-18529 09-17)

The influence of preliminary hot rolling on the mechanical properties of the eutectoid zinc-aluminum was investigated. Billets of the eutectoid alloy were subjected to rolling at 300 C with a 60% reduction in two different initial states: in the cast state and after homogenizing annealing at 350 C for a week with subsequent slow cooling. It was concluded that preliminary hot rolling leads to a sharp increase in plasticity both of the cast and of the annealed zinc-aluminum eutectoid with the appearance of superplasticity. The highest indices of plasticity are observed in cast hot rolled alloys at 200, 275, and 300 to 350 C, and in annealed alloys with subsequent reduction of the samples near 200 to 225 and at 275 C. The fracture velocities exert substantial influence on the index of plasticity of the hot rolled alloys. Author

N73-18531 Joint Publications Research Service, Arlington, Va.
CHANGE IN THE FLOW CURVES OF A SUPERPLASTIC ALUMINUM-ZINC ALLOY WITH TEMPERATURE
R. K. Aubakirova, A. A. Presnyakov, and A. N. Karpenyuk *In its* Selected Transl. on Met. 30 Oct. 1973 p 11-23 refs (For availability see N73-18529 09-17)

The results are presented of a detailed study of the superplastic flow of samples of an aluminum-zinc alloy of eutectoid composition in different states as a function of temperature. Findings of the study include the following: (1) The flow curves during tension of superplastic samples of the eutectoid have a complex shape and consist of several regions corresponding to a definite period of the deformation. (2) The different temperature intervals and states are represented by their own definite type of flow curves. (3) The strength of the nonequilibrium samples is an order of magnitude lower than in the same alloy in the ordinary state. (4) The phenomenon of true superplasticity is observed for the aluminum-zinc alloy in the temperature region from 100 to 300 C. D.L.G.

N73-18532 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF SMALL MAGNESIUM ADDITIVES ON THE EFFECT OF SUPERPLASTICITY IN AN ALUMINUM-ZINC EUTECTOID
S. M. Azhibayeva, A. A. Presnyakov, and U. K. Duysemaliyev *In its* Selected Transl. on Met. 30 Oct. 1973 p 24-31 refs (For availability see N73-18529 09-17)

The influence was investigated of different concentrations of magnesium on the effect of superplasticity of an Al-Zn eutectoid alloy as a function of temperature and velocity of deformation. It was found that small additives of magnesium in amounts of 0.05, 0.10, and 0.15 weight percent reduce by 5 to 9 times the plasticity of a quenched Al-Zn eutectoid at room temperature and different deformation velocities. Additionally, additives of magnesium cause a significant reduction in the effect of superplasticity in the alloy; the quantitative side of which also depends on concentration of the element introduced and tensile velocity. D.L.G.

N73-18533 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF TENSILE VELOCITY ON THE PLASTICITY OF COLD-DEFORMED (FOLLOWING HOT ROLLING) TECHNICALLY PURE NICKEL
A. A. Presnyakov, R. B. Alimanova, and G. M. Volkogon *In its* Selected Transl. on Met. 30 Oct. 1973 p 32-42 refs (For availability see N73-18529 09-17)

An investigation of the temperature curves of the relative expansion of technically pure nickel, cold deformed with different degrees of rolling reduction, revealed two characteristic regions of change in plasticity; a primary one and a secondary one. It

was also found that the pulling velocity ambiguously influences migration of the anomalies in plasticity along the temperature scale. In addition, the fracture velocity has a complex influence on the values of the plasticity in the zones of the anomalous behavior of the relative linear expansion. D.L.G.

N73-18534 Joint Publications Research Service, Arlington, Va.
SUPERPLASTICITY OF DEFORMED ALPHA-BRASSES AND PURE COPPER
A. Ya. Chasnikov and V. V. Chervyakova *In its* Selected Transl. on Met. 30 Oct. 1973 p 43-46 refs (For availability see N73-18529 09-17)

The influence of preliminary deformation on superplasticity was investigated for alpha-brasses and oxygen-free copper with a purity of 99.99 percent. The results indicate that with increase in the degree of preliminary cold working, the linear expansion of brass samples at room temperature drops from 50 to 20 percent. It was also found that the change in the linear expansion of the material in the region of average temperatures undergoes a number of anomalies primarily at 200, 400-450, and 600-650 C rather than occurring monotonically. In addition, the constant anomalies in plasticity including superplasticity in copper and brass in the temperature region of 800-850 C indicates the existence of transformations in the materials at that temperature range. D.L.G.

N73-18535 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF MICRODOPING WITH CERIUM ON THE QUALITY OF FRACTURES IN STRUCTURAL STEELS
V. V. Polyukhov *In its* Selected Transl. on Met. 30 Oct. 1973 p 47-51 refs (For availability see N73-18529 09-17)

Tests were conducted to determine the influence of cerium on the quality of cast low-carbon chromium-nickel-molybdenum steel. Conclusions drawn from the test results include the following: (1) The introduction into molten steel of up to 0.1 percent cerium has no significant influence on the change in critical points and other properties of the steel; with increase in the amount of cerium above 0.1 percent the rare earth element is a doping element. (2) With respect to the cast low-carbon medium-alloy steels, cerium is not a desulfurizer but is capable only of a comparatively uniform distribution of sulfur throughout the entire cross section of the castings. D.L.G.

N73-18536*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF DIFFUSIONAL CREEP ON PARTICLE MORPHOLOGY OF POLYCRYSTALLINE ALLOYS STRENGTHENED BY SECOND PHASE PARTICLES
John D. Wittenberger and Donald R. Behrendt Washington Mar. 1973 18 p refs
(NASA-TN-D-7177; E-7248) Avail: NTIS HC $3.00 CSCL 11F

Diffusional creep in a polycrystalline alloy containing second-phase particles can disrupt the particle morphology. For alloys which depend on the particle distribution for strength, changes in the particle morphology can affect the mechanical properties. Recent observations of diffusional creep in alloys containing soluble particles (gamma-prime strengthened Ni base alloys) and inert particles have been reexamined in light of the basic mechanisms of diffusional creep, and a generalized model of this effect is proposed. The model indicates that diffusional creep will generally result in particle-free regions in the vicinity of grain boundaries serving as net vacancy sources. The factors which control the changes in second-phase morphology have been identified, and methods of reducing the effects of diffusional creep are suggested. Author

N73-18537*# TRW Equipment Labs., Cleveland, Ohio. Materials Technology Labs.
DEVELOPMENT OF A POWER METALLURGY SUPERALLOY FOR USE AT 1800-2000 F (980-1090 C) Final Report, 11 May 1970 - 20 Sep. 1973
Charles S. Kortovich 15 Feb. 1973 98 p refs
(Contract NAS3-13488)
(NASA-CR-121099; TRW-ER-7624) Avail: NTIS HC $7.00 CSCL 11F

A program was conducted to develop a powder metallurgy nickel-base superalloy for 1800-2000 F (980-1090 C) temperature applications. The feasibility of a unique concept for alloying carbon into a superalloy powder matrix and achieving both grain growth and a discrete particle grain boundary carbide precipitation was demonstrated. The process consisted of blending metastable carbides with a carbon free base alloy and consolidating this blend by hot extrusion. This was followed by heat treatment to grow a desired ASTM No. 2-3 grain size and to solution the metastable carbides to allow precipitation of discrete particle grain boundary carbides during subsequent aging heat treatments. The best alloy developed during this program was hydrogen-atomized, thermal-mechanically processed, modified MAR-M246 base alloy plus VC (0.28 w/o C). Although below those for cast MAR-M246, the mechanical properties exhibited by this alloy represent the best combination offered by conventional powder metallurgy processing to date. Author

N73-18538# Defence Research Establishment Valcartier (Quebec).
METALLOGRAPHIC INTERPRETATION OF IMPACT OGIVE PENETRATORS
G. J. Irwin Oct. 1972 50 p refs
(DREV Proj. 97-01-19)
(DREV-R-652/72) Avail: NTIS HC $4.50

A metallographic study was carried out on uranium-based and tungsten-based penetrators which had impacted a semi-infinite soft steel target at normal incidence. The uranium alloys show a great tendency to shear adiabatically at the surface. This is believed to be a function of: (a) low work hardening capability, (b) severe stress concentration at the abrupt change in penetrator cross section produced during impact deformation, and (c) bending as a secondary influence. Adiabatic shear bands are also a site for ductile fracture. Martensitic U-2%Mo is mechanically highly unstable while U-1%Mo-.7%Nb-.7%Zr, in the lamellar condition shows promise as a potential alternative to W-Ni-Cu at impact velocities above 0.76 mm/microns. The uranium alloy must be sufficiently hard, however, to avoid significant mushrooming. Author

N73-18539# Gould, Inc., Cleveland, Ohio.
RECENT DEVELOPMENTS IN TITANIUM P/M
Edward Thellmann [1972] 14 p
Avail: NTIS HC $3.00

The history of the production and use of titanium structures produced by powder metallurgy techniques is reviewed along with a discussion of the economic factors affecting the increased usage of items produced by this method. Examples of types of structures and parts made by this method are presented along with predictions of expected increases in usage in industry, particularly the aircraft industry. A.L.

N73-18540*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
METALLURGICAL EVALUATION OF FACTORS INFLUENCING THE DUCTILITY OF AGED T-111 Final Report
R. E. Gold Dec. 1972 89 p refs
(Contract NAS3-15560)
(NASA-CR-120865; WANL-M-FR-72-012) Avail: NTIS HC $6.50 CSCL 11F

The metallurgical factors influencing the ductility of T-111 (Ta-8W-2Hf) alloy following long-time exposures of GTA welds and tubing in the temperature range 982 C (1800 F) through 1316 C (2400 F) were evaluated by means of scanning and transmission electron microscopy, Auger electron emission spectroscopy, and optical metallographic procedures. No classical aging response occurs in the alloy over the temperature range studied. The ductility impairment implied by previous investigations is not the result of microstructural response of the alloy to thermal exposures. Intergranular failure in the GTA sheet welds appears the result of random contamination by silicon, potassium, and/or fluorine at the grain boundaries of the fusion zones. Exposure to lithium at high temperatures had no adverse effects on the ductility of T-111 tubing. These materials were, however, sensitive to post-age handling and testing procedures. Author

N73-18541*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROSTRUCTURAL STUDY OF THE NICKEL-BASE ALLOY WAZ-20 USING QUALITATIVE AND QUANTITATIVE ELECTRON OPTICAL TECHNIQUES

Stanley G. Young Washington Mar. 1973 29 p refs
(NASA-TN-D-7209; E-7250) Avail: NTIS HC $3.00 CSCL 11F

The NASA nickel-base alloy WAZ-20 was analyzed by advanced metallographic techniques to qualitatively and quantitatively characterize its phases and stability. The as-cast alloy contained primary gamma-prime, a coarse gamma-gamma prime eutectic, a gamma-fine gamma prime matrix, and MC carbides. A specimen aged at 870 C for 1000 hours contained these same constituents and a few widely scattered high W particles. No detrimental phases (such as sigma or mu) were observed. Scanning electron microscope, light metallography, and replica electron microscope methods are compared. The value of quantitative electron microprobe techniques such as spot and area analysis is demonstrated. Author

N73-18542# Joint Publications Research Service, Arlington, Va.
ECONOMIC EFFECTIVENESS OF POWDER METALLURGY OF TITANIUM
A. I. Kanyuk, Yu. G. Olesov, and V. S. Ustinov 13 Feb. 1973 10 p refs Transl. into ENGLISH from Tsvetn. Metally (Moscow), no. 5, 1972 p 68-71
(JPRS-58217) Avail: NTIS HC $3.00

A discussion is presented of how with powder metallurgy raw materials can be used efficiently, mechanical processing can be minimized, and various compositions with given porosity, strength, heat, and corrosion resistance can be produced. Author

N73-18543# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF SEVERAL TECHNOLOGICAL PARAMETERS ON THE STRENGTH PROPERTIES OF THE EI893L
M. D. Nikitin, A. V. Malkevich, V. P. Prozorov, and V. K. Pustovoyt 2 Feb. 1973 8 p ref Transl. into ENGLISH from Energomashinostr. (Leningrad), no. 6, Jun. 1971 p 33-35
(JPRS-58137) Avail: NTIS HC $3.00

An investigation was made of several of the strength characteristics of the EI893L alloy during extraction and pouring in vacuum and in air as a function of the mode of heat treatment. Author

N73-18544# Joint Publications Research Service, Arlington, Va.
PHYSICAL CHARACTERISTICS OF MAGNESIOTHERMAL TITANIUM SPONGE WITH HARDNESS LESS THAN HB 100
R. A. Sandler, E. A. Arutyunov, A. S. Kuzmenko, and V. I. Nazarova 28 Feb. 1973 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), no. 1, 1973 p 50-56
(JPRS-58347) Avail: NTIS HC $3.00

Data are reported on tests conducted on the production of high-quality spongy titanium with low residual chloride concentration after vacuum separation. Author

N73-18545# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
AN INVESTIGATION OF METAL CONTAINING POLYIMIDE FILMS BY INFRARED SPECTROSCOPY METHOD
I. Ya. Ravich, O. V. Neklyudova, T. N. Toroptseva, and L. G. Gindin Feb. 1973 12 p refs Transl. into ENGLISH from J. Appl. Spectrosc. (USSR), v. 9, no. 4, Oct. 1968
(TR-62) Avail: NTIS HC $3.00

Contemporary technology has created a need for polymers possessing high thermal stability as well as increased electrical and thermal conductivities and magnetic permeability. Attempts at incorporating silver either in metallic form, or as silver acetate, into the polyamic acid state of the polymer produced from the condensation of pyromellitic dianhydride and 4,4'-diaminodiphenyl ether are described. Upon thermal aging, the infrared spectra of the untreated film and the film containing finely dispersed silver metal indicate cyclization of the amic acid linkages to imide linkages, whereas the film treated with silver acetate shows only partial imidization. This suggests that silver metal cannot be incorporated into the polyimide backbone but silver in the acetate form can be incorporated into the chain either by reaction with or complexation with the amic acid linkage. Data is presented to differentiate between these two mechanisms. Author

N73-18546# Joint Publications Research Service, Arlington, Va.
TIN AS AN ALLOYING ELEMENT IN HEAT-RESISTANT ALLOYS
Ye. G. Nazarov and S. B. Maslenkov 6 Feb. 1973 7 p refs Transl. into ENGLISH from Metalloved. Term. Obrab. Metal. (Moscow), no. 3, 1972
(JPRS-58159) Avail: NTIS HC $3.00

Results of tests on the effect of tin on the properties and structure of nickel-chrome alloys of the type KhN78T (EI435), are reported. Author

N73-18547*# Scripta Technica, Inc., Washington, D.C.
MINERAL COMPOSITIONS OF PLACER PLATINUM FROM TESHIO IN HOKKAIDO, JAPAN
Y. Urashima, T. Wakabayashi, and Y. Terasaki NASA Mar. 1973 37 p refs Transl. into ENGLISH from Kagoshima Daigaku Rika Hokoku (Kagoshima), no. 21, 25 Sep. 1972 p 119-135
(Contract NASw-2036)
(NASA-TT-F-14625) Avail: NTIS HC $4.00 CSCL 11F

Microscopic properties, especially microhardness and reflectivity, of placer platinum grains from Teshio in Hokkaido have been studied. The grains have been analyzed by electron probe X-ray microanalyzer. Polyxen, ferroplatinum, cuprian ferroplatinum, osmium, iridosmium have been identified. The platinum alloys include stibiopalladinite, lautire (?), hollingworthite (?), undetermined Rh-Pt-Cu-S mineral, bornite and covellite. Gold and apatite (?)-bearing Fe-Ti-O mineral have been studied. Author

N73-18548# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ELECTRONIC STRUCTURE OF TRANSITION METALS AND THEIR ALLOYS Ph.D. Thesis - Paris Univ. [STRUCTURE ELECTRONIQUE DES METAUX DE TRANSITION ET DE LEURS ALLIAGES]
Francois Ducastelle 1972 149 p refs In FRENCH; ENGLISH summary
(ONERA-P-144) Avail: NTIS HC $9.50

The physical properties related to the cohesion of transition metals were studied, using a method based on first moment calculations of the density states within the strong binding approximation. This method, which provides semi-quantitative results without band calculation, is described and applied to the study of cohesive energy, relative stability of different crystal structures, and elastic moduli. An agreement is found with experimental results for physical property variations along a transition series. Disordered alloys of transition metals were also studied; in particular, the coherent potential approximation was generalized. Approximations obtained are examined and compared for limiting cases such as dilute alloy, virtual crystal limit, and atomic limit. Some numerical results obtained using a one dimensional model are also given. ESRO

N73-18549# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
THE EFFECT OF BIAXIAL STRAIN DEFORMATION ON THE DYNAMIC FRACTURE OF 6061-T6 ALUMINUM
Ian M. Fyfe and Robert M. Schmidt Sep. 1972 43 p refs
(Contract DA-ARO(D)31-124-70-G91)
(AD-752832; AROD-9504-3-E) Avail: NTIS CSCL 11/6

Fracture induced by the reflection of stress waves has been examined in the past using experiments which are characterized by uniaxial strain conditions, and where the maximum principal stress is normal to the fracture plane. This report describes dynamic fracture where the strains are biaxial and the maximum principal stress is tangential to the fracture surface. Author (GRA)

N73-18550# Little (Arthur D.), Inc., Cambridge, Mass.
CHARACTERIZATION OF IR WINDOWS Final Technical Report
John S. Haggerty and Edward T. Peters Nov. 1972 34 p refs Sponsored, in part by ARPA
(Contract N00014-72-C-0092)
(AD-752783; ADL-74010) Avail: NTIS CSCL 20/6

High resistivity GaAs is a candidate window material for high power CO2 lasers emitting at 10.6 micrometers. The measured absorptions at this wavelength have typically been in the range 0.01 to 0.025/cm. Other candidate materials have been prepared with absorptivities as low as 0.0006/cm. Consequently, a characterization program was undertaken to determine if the measured absorptivities are intrinsic to GaAs or alternatively are the result of a structural or chemical defect common to all melt grown, high resistivity GaAs. Evaluation samples from boules prepared under a wide range of growth conditions were supplied. Characterization procedures emphasized direct observation of structure, using techniques having successively higher limits of resolution; methods included optical and infrared microscopy, X-ray topography and transmission electron microscopy. Author (GRA)

N73-18551# Naval Research Lab., Washington, D.C.
A PHASE EQUILIBRIUM DIAGRAM FOR THE VANADIUM-GALLIUM SYSTEM
V. M. Pan and V. N. Svechnikov, ed. 4 Dec. 1972 14 p refs Transl. into ENGLISH from the book "Struktura Metallicheskikh Splavov" Kiev, Naukova Dumka, 1966 p 56-66
(AD-752877; NRL-Trans-1260) Avail: NTIS CSCL 11/6

One of the most promising materials for superconducting solenoids is the intermetallic compound V3Ga. The report presents a phase equilibrium diagram of the vanadium-gallium system, the diagram being more detailed in the range of concentrations where the compound V3Ga exists. The phase equilibrium diagram was constructed by means of differential-thermal, quenching-X-ray-structural and quenching-microstructural analysis. Eight phases were observed. Author (GRA)

N73-18552# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.
BETA TITANIUM ALLOYS
R. A. Wood Sep. 1972 229 p refs
(Contract DSA900-73-C-0922)
(AD-753439; MCIC-72-11) Avail: NTIS CSCL 11/6

The report reviews and summarizes the information available on selected beta titanium alloys. Emphasis is placed on four commercial compositions; a few other compositions in the class are considered briefly, including those for some foreign alloys. Comparisons of the alloys are offered on a limited basis where sufficient data are available. Author (GRA)

N73-18553# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FATIGUE STRENGTH OF JOINTS MADE BY FRICTION WELDING
A. I. Khristoforov, A. G. Seleznev, I. L. Tsymbal, and A. K. Balyuk 15 Nov. 1972 11 p refs Transl. into ENGLISH from Vestn. Kharkov Politekh. Inst. (USSR), v. 83, no. 35, 1969 p 82-84
(AF Proj. 7351)
(AD-753488; FTD-HT-23-1132-72) Avail: NTIS CSCL 13/5

Weldments made of dissimilar metals were tested for fatigue strength. Specimens 12 mm diameter and prepared from the steel R18 and 45 were investigated. Fatigue tests were made on specimens obtained by friction welding and by electrocontact welding by fusion. Comparison of these results shows that welding by friction is not inferior in strength to electrocontact welding by the fusion method and that both methods give practically equally strong weldments. Author (GRA)

N73-18554# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.
DAMAGE TOLERANT DESIGN HANDBOOK. A COMPILATION OF FRACTURE AND CRACK GROWTH DATA FOR HIGH STRENGTH ALLOYS
Dec. 1972 338 p refs Sponsored by AF
(AD-753774; MCIC-HB-01) Avail: NTIS CSCL 11/6

This is the first edition of a compilaton of fracture mechanics data on high-strength aluminum alloys, alloy steels, stainless steels, and titanium alloys. The data represent state-of-the-art information on critical plane-strain stress intensity factors, plane-stress and transitional stress intensity factors, threshold stress intensity factors in corrosive media, sustained-load crack-growth rates in corrosive media, and fatigue crack growth rates. Author (GRA)

N73-18555# Naval Research Lab., Washington, D.C.
EFFECT OF SHEET THICKNESS ON THE FRACTURE RESISTANCE K SUB c PARAMETER FOR TITANIUM ALLOYS Final Report
C. N. Freed, A. M. Sullivan, and J. Stoop 8 Nov. 1972 23 p refs
(RR0220146)
(AD-753198; NRL-7464) Avail: NTIS CSCL 11/6

The influence of sheet thickness on the plane stress fracture resistance parameter K sub c has been investigated for four high-strength titanium alloys. The center-cracked-tension (CCT) specimen was employed over a thickness range from 1/32 to 1/8 in. The effect of thickness on K sub c varied with each alloy. The more frangible alloys evidenced peak K sub c values in thinner specimens than those alloys manifesting higher fracture resistance. Slit tips with 1-mil radii indicated lower K sub c values than tips of 3 to 5 mils. No influence of initial crack length was noted over the range studied. The data were applied to a model which postulates the K sub c dependency on thickness. Author (GRA)

N73-18556# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
STRESS-CORROSION CRACKING OF Al-ZnMg ALLOYS: THE CORROSION BEHAVIOR OF GRAIN BOUNDARY CONSTITUENTS
A. J. Sedriks, J. A. S. Green, and D. L. Novak Dec. 1972 19 p refs
(Contract N00014-67-C-0496; NR Proj. 031-716)
(AD-753273; RIAS-TR-72-25C; TR-6) Avail: NTIS CSCL 11/6

Since the grain-boundary constituents in Al-Zn-Mg alloys are generally too fine for their corrosion behavior to be studied in situ, an experimental approach involving simulation was adopted. This involved the examination of the corrosion behavior of a small ingot of MgZn2, the Al-Zn-Mg alloy in the as-quenched state, and pure aluminum. The pure aluminum and the as-quenched alloy were considered to represent the two limiting cases of the material comprising the precipitate-free zone; pure aluminum representing the limiting case of the solute-depleted region and the as-quenched alloy the vacancy depleted region. Author (GRA)

N73-18557# Pennsylvania Univ., Philadelphia. School of Chemical Engineering.
HYDROGEN PERMEATION AND EMBRITTLEMENT IN FERROUS MATERIALS
T. K. Govindan Namboodhiri and Leonard Nanis Nov. 1972 93 p refs
(Contract N00014-67-A-0216-0004; NR Proj. 036-077)
(AD-752828; UPH2-TR-004) Avail: NTIS CSCL 11/6

The sensitive electrochemical permeation technique was used in conjunction with scanning electron microscopy and tensile loading to determine (1) hydrogen diffusivity and solubility, (2) effect of plastic deformation on the above parameters, and (3) structural features and kinetics of hydrogen embrittlement, in Armco iron and 4340 steel. Author (GRA)

N73-18558# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
THE SOLUTIONING AND AGING REACTIONS AND THEIR EFFECT ON HARDNESS AND MICROSTRUCTURE IN SOME COLUMBIUM BASE ALLOYS
N. C. Birla and M. Hoch Sep. 1972 143 p refs
(Contract DAHC04-69-C-0016)
(AD-752930; THEMIS-72-31; AROD-T-4-50-E) Avail: NTIS CSCL 11/6

A study was made to investigate the solutioning and aging reactions and their effects on microstructure and hardness in twenty-four experimental columbium-base alloys, involving Cb-C, Cb-Si-C, Cb-15Hf-C, Cb-15Hf-C-Si, Cb-33Hf-C and Cb-33Hf-C-Si systems. The aging reactions in the Cb-15Hf-C, Cb-15Hf-C-Si, and Cb-33Hf-C-Si alloys are characterized by precipitation of the complex monocarbide (Cb, Hf) (C, O, N) phase. Replacement of some of the carbon by silicon in the Cb-15Hf-1C alloys raises the overaging temperature from 800 C to 1000 C and leads to strength retention for longer times than the alloys which contain carbon only. Author (GRA)

N73-18559# California Univ., Los Angeles. School of Engineering and Applied Science.
SOME CRITICAL STUDIES OF MACROSCOPIC AND MICROSCOPIC FRACTURE CRITERIA FOR STEEL
A. S. Tetelman, J. N. Robinson, S. A. Mohamed, and S. Ensha Sep. 1972 43 p refs
(Contracts DAHC04-68-C-0008; DAHC04-69-C-0008; DA Proj. 200-61102-B-32D)
(AD-752446; UCLA-ENG-7290; AROD-8016-8-MC; TR-9) Avail: NTIS CSCL 11/6

Research shows how plane strain values of the crack tip opening displacement, COD, can be determined on pre-cracked Charpy specimens loaded well beyond general yield. The measurements are then used to determine K sub Ic values that agree with valid measurements on twelve inch thick specimens of A533 steel. The results of an experimental and analytic visioplasticity investigation is described which allows a determination to be made of the critical local strain required to initiate fracture at the tip of a sharp notch. The report also presents the results and analysis of a study to determine quantitative relations between K sub Ic (and K sub Id) and microscopic variables such as grain size for cleavage fracture that occurs at low temperatures. Author (GRA)

N73-18560# Dayton Univ. Research Inst., Ohio.
ENGINEERING DESIGN DATA FOR ALUMINUM ALLOY 7475 IN THE T761 AND T61 CONDITION Technical Report, Apr. 1971 - Feb. 1972
Russell R. Cervay Sep. 1972 28 p refs
(Contract F33615-71-C-1054; AF Proj. 7381)
(AD-753709; UDRI-TR-72-25; AFML-TR-72-173) Avail: NTIS CSCL 11/6

Tensile, exfoliation, fatigue, and fatigue crack growth properties were determined for a new aluminum sheet alloy, 7475, in two heat treated conditions, T761 and T61. The tensile properties of the T61 sheet were superior to those for the T761 sheet. The fatigue crack growth properties were the same from heat treatment to heat treatment and were unaffected by crack orientation in the plate. Conventional notched and unnotched fatigue data showed in the 7475 alloy had superior fatigue resistance compared to presently-in-use aluminum alloys. The exfoliation properties of the T761 sheet were slightly superior to those of the T61 heat treatment. Author (GRA)

N73-18561# Army Materials and Mechanics Research Center, Watertown, Mass.
THE CORROSION BEHAVIOR OF TITANIUM ALLOYS IN CHLORIDE SOLUTIONS: MATERIALS FOR SURGICAL IMPLANTS
Milton Levy, Daniel B. Dawson, Gilbert N. Sklover, and David W. Seitz, Jr. Nov. 1972 19 p refs
(DA Proj. 1T0-62105-A-328)
(AD-753573; AMMRC-TR-72-33) Avail: NTIS CSCL 11/6

Because certain titanium alloys are of interest as surgical implants, the corrosion behavior of alloys Ti-8Al-1Mo-1V in both the single and duplex annealed conditions and Ti-6Al-6V-2Sn at yield strength levels of 140, 160, and 180 ksi were studied in 0.17M sodium chloride solution (the approximate NaCl concentration in blood, plasma, and lymph) and Hanks's physiological solution (a fairly close imitation, from the chemical viewpoint, of the fluid in muscle and bone) at a temperature of 37 C by electrochemical means, i.e., potential-time, anodic polarization, current density-time for the anodes under potentiostatic control at the equilibrium potential. Electrochemical measurements were made with these alloys in both the unstressed and stressed conditions, and then under conditions of cyclic stress.
Author (GRA)

N73-18562# Connecticut Univ., Storrs. Dept. of Metallurgy.
ON CREEP-FATIGUE INTERACTION DURING CRACK GROWTH
P. N. Atanmo and A. J. McEvily, Jr. Oct. 1972 23 p refs
(Contract F44620-69-C-0011; AF Proj. 9560)
(AD-753688; UC-Met-9-72; AFOSR-72-2328TR) Avail: NTIS CSCL 11/6

The interaction between creep and fatigue processes was investigated during crack growth in sheet specimens of the aluminum alloy 5052 at 400F. Fractographic studies indicate that at high frequencies (1/30 sec. per cycle) the fatigue process of crack advance is dominant, whereas at low frequencies (e.g., 60 sec. per cycle) the creep process prevails. It was found that at low frequencies and at a low peak stress level (10 ksi) the cyclic process could lead to an increase in the total time to failure as compared to the creep process alone. Author (GRA)

N73-18563# Connecticut Univ., Storrs. Dept. of Metallurgy.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF THERMAL RATCHETING
A. V. A. Swaroop and A. J. McEvily, Jr. Oct. 1972 24 p refs
(Contract F44620-69-C-0011; AF Proj. 9560)
(AD-753686; UC-MET-8-72; AFOSR-72-2324TR) Avail: NTIS CSCL 11/6

A three-bar assembly was used to simulate experimentally ratcheting behavior of loaded structural components subjected to non-uniform thermal cycling. The existing theories have been extended, and a high degree of correlation is obtained between the improved theory and experimental results. Author (GRA)

N73-18670 Atomic Energy of Canada Ltd., Chalk River (Ontario).
STRESS CORROSION CRACKING OF ZIRCONIUM ALLOYS
B. Cox *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 7-12 refs (For availability see N73-18668 09-22)

N73-18671 Atomic Energy of Canada Ltd., Chalk River (Ontario).
STRESS-CORROSION CRACKING ZIRCONIUM ALLOY FUEL ELEMENT SHEATHS IN IODINE VAPOUR
J. C. Wood *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 13-15 refs (For availability see N73-18668 09-22)

N73-18672 Atomic Energy of Canada Ltd., Chalk River (Ontario).
DISTRIBUTION OF ZIRCONIUM HYDRIDE IN ZIRCALOY
J. F. R. Ambler *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 16-18 (For availability see N73-18668 09-22)

N73-18673 Atomic Energy of Canada Ltd., Chalk River (Ontario).
CRYSTAL DEFECTS STUDIED BY INTERNAL FRICTION
I. G. Ritchie *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 19-22 refs (For availability see N73-18668 09-22)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-18564*# Princeton Univ., N.J. Guggenheim Labs. for the Aerospace Propulsion Sciences.
EROSION OF GRAPHITE SURFACE EXPOSED TO HOT SUPERSONIC HYDROGEN GAS
Om P. Sharma Apr. 1972 35 p refs
(Grant NGR-31-001-230)
(NASA-CR-130812; AMS-1038) Avail: NTIS HC $3.75 CSCL 11D

A theoretical model based on laminar boundary layer flow equations is developed to predict the erosion rate of a graphite (AGCarb-101) surface exposed to a hot supersonic stream of hydrogen gas. The supersonic flow in the nozzle outside the boundary layer formed over the surface of the specimen is determined by assuming one-dimensional isentropic conditions. An overall surface reaction rate expression based on the experimental studies by Clarke and Fox is used to describe the interaction of hydrogen with graphite. A satisfactory agreement is found between the results of the computation, and the available experimental data. Some shortcomings of the model, and further possible improvements are discussed. Author

N73-18565*# Goodyear Aerospace Corp., Akron, Ohio.
DESIGN IMPROVEMENT, QUALIFICATION TESTING, PURGE AND VENT INVESTIGATION, FABRICATION, AND DOCUMENTATION OF A GAC-9 INSULATION SYSTEM Annual Summary Report

C. B. Shriver, J. N. Apisa, and A. H. Kariotis Nov. 1971 194 p refs
(Contract NAS8-26091)
(NASA-CR-124052; GER-14915-S/9) Avail: NTIS HC $11.75 CSCL 11D

Results of the research and development program to determine the purge and vent characteristics of the GAC-9 insulation system are summarized. The work scope comprised: (1) literature survey; (2) design improvement and insulation effort; (3) testing; and (4) evaluation of test results. Program objectives to be realized are: (1) definition of purge gas flow characteristics of the GAC-9 insulation system through laboratory measurements; and (2) demonstration of insulation effectiveness as a system for prelaunch purging and launch venting of the 76-cm diameter calorimeter, which is a subscale model simulating a realistic type of GAC-9 insulation application. Author

N73-18566*# Little (Arthur D.), Inc., Cambridge, Mass.
THE EFFECT OF RESIDUAL STRESS ON PERFORMANCE OF HIGH TEMPERATURE COATINGS Final Report
8 Nov. 1972 24 p refs
(Contract NASw-2255)
(NASA-CR-130813) Avail: NTIS HC $3.25 CSCL 11C

Techniques for measurement of residual stress in MoSi2 coatings and the determination of stress in coatings prepared by metallíding, pack and slurry processes are discussed. The stress level can be determined by stress induced deflections or by X-ray techniques. The deflection method is most direct. It is based on the fact that a thin substrate, coated on one side only, is usually curved at room temperature. The radius of curvature is easily measured and readily related to residual stress. Author

N73-18567*# Battelle-Northwest, Richland, Wash. Pacific Northwest Labs.
DEVELOPMENT OF TECHNIQUES AND INSTRUMENTATION FOR THE NONDESTRUCTIVE EVALUATION OF MULTI-LAYER INSULATION Final Report
Nov. 1972 64 p refs
(Contract NAS8-27479)
(NASA-CR-124106) Avail: NTIS HC $5.25 CSCL 11D

The development of techniques and instrumentation suitable for the nondestructive evaluation of purged multilayer insulation prior to and after a shuttle orbiter flight is discussed. These techniques are desirable because of the possibility that corrosion, compression, or tearing of the insulation will degrade the performance of the insulation during subsequent flights. A second objective was the application of the developed technology to the evaluation of other insulation types. Three nondestructive evaluation techniques, electromagnetic, thermal, and acoustic were selected for evaluation. The results of evaluation of each technique are described. Author

N73-18568*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
CHARACTERISTICS OF A GELLED LIQUID HYDROGEN POLYPHENYLENE OXIDE (PPO) FOAM OPEN-CELL INSULATION SYSTEM, PHASE 1 Final Report
15 Feb. 1973 93 p refs
(Contract NAS8-27203)
(NASA-CR-124114; GDCA-632-3-169) Avail: NTIS HC $6.75 CSCL 11D

A large scale gel production and storage facility and a small scale facility, the latter used for detailed visual examination of the gel/PPO foam interface, were developed. A subcontract was given to investigate techniques for the production of gelled liquid hydrogen, develop a process design for scale-up to a 1.89 cu m (500 gallon) gel production and storage facility, determine gel transfer characteristics, determine the solubility rate of gaseous helium in the gel, and investigate the gross gel/PPO foam interfacial phenomena. An inside-tank process for scaled-up production of gelled liquid hydrogen was selected. No detectable gel structure degradation occurred during repeated shearing. The viscosity of gelled liquid hydrogen at shear rates of 300/sec and higher is 2 to 5-fold greater than that of neat liquid hydrogen. No clogging problems were encountered during the transfer of gelled liquid hydrogen through warmed transfer lines. The solubility rate of helium in liquid hydrogen was significantly reduced by the presence of gel structure. The boil-off rates from gelled liquid hydrogen were reduced from 25 to 50 percent compared to those observed for the neat liquid hydrogen under compatible conditions. The polyphenylene oxide (PPO) foam insulation was found to be compatible with liquid ethane. Author

N73-18569*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION, WEAR, AND THERMAL STABILITY STUDIES OF SOME ORGANOTIN AND ORGANOSILICON COMPOUNDS
Williams R. Jones, Jr. Washington Mar. 1973 18 p refs
(NASA-TN-D-7175; E-6990) Avail: NTIS HC $3.00 CSCL 11H

Thermal decomposition temperatures were determined for a number of organotin and organosilicon compounds. A ball-on-disk sliding friction apparatus was used to determine the friction and wear characteristics of two representative compounds, (1) 3-tri-n-butylstannyl (diphenyl) and (2) 3-tri-n-butylsilyl (diphenyl). Friction and wear test conditions included a 1-kg load, 25 to 225 C disk temperatures, and a dry air atmosphere. The tin and silicon compounds yielded friction and wear results either lower than or similar to those obtained with a polyphenyl ether and a C-ether. The maximum thermal decomposition temperatures obtained in the silicon and tin series were 358 and 297 C, respectively. Increasing the steric hindrance around the silicon or tin atoms increased the thermal stability. Future work with these compounds will emphasize their use as antiwear additives rather than base fluids. Author

N73-18570# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MECHANICAL BEHAVIOUR OF UNIDIRECTIONALLY SOLIDIFIED COMPOSITES
Herve Bibring 1972 70 p refs Presented at Conf. on Composites in-situ, Lakeville, Conn., 5-8 Sep. 1972
(ONERA-TP-1147) Avail: NTIS HC $5.50

The tensile, compressive, creep, and fatigue properties, impact toughness and anisotropic effects, and thermal cycling of in-situ grown composites are reviewed. While these mechanical properties were generally poor for the first unidirectionally solidified composites, recent development concerned with small additions in the melt has led to noticeable improvements in quality. Author

N73-18571*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET AND CHARGED PARTICLE IRRADIATION OF PROPOSED SOLAR CELL COVERSLIDE MATERIALS AND CONDUCTIVE COATINGS FOR THE HELIOS SPACECRAFT
J. Fry and C. A. Nicoletta Jun. 1972 112 p refs
(NASA-TM-X-65945; X-765.72-205) Avail: NTIS HC $7.75 CSCL 11C

Coverslide materials consisting of Corning 7940 fused silica, multilayers of titanium and manganese oxides (blue reflector), and indium oxide (conductive-coating) were exposed to 16 UVSC up to 800 EUVSH in vacuum. Slight changes in optical transmittance and optical absorptance were found in the (200-360) millimicron regions of the fused silica and conductive coating respectively. Exposure to 4 KeV protons and 4.5 KeV electrons in vacuum, produced decreases of several percent in transmittance, (200-360) millimicron region in the fused silicas after total fluxes less or = 10 to the 14th power particles/sq cm. Sheet resistance of the conductive coating increased above 1.0 kilo-ohm/square after a total flux less or = 10 to the 14th power particles/sq cm. Solar cells with coverglasses utilizing the indium oxide conductive coating were exposed to 1 Mev electrons and 1 Mev protons in air and in vacuum. Total fluxes ranged from 10 to the 11th power particles/sq cm to 10 to the 15th power particle/sq cm. There was no appreciable degradation in the resistance of the conductive coating during or after these tests. Author

N73-18572# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics.
ENVIRONMENTAL TESTING OF CLOSED PORE INSULATION (CPI). 2: SALT SPRAY TESTING

Carl Feldman and Michael Russak Feb. 1973 20 p refs
(RM-570) Avail: NTIS HC $3.00

A series of tests was performed on surface insulation material, CPI, to demonstrate its suitability for the shuttle orbiter thermal protection system. Salt spray testing was done to determine the effect of sea water mist on CPI's performance during simulated reentry thermal cycling. This type of testing is mandatory because of the sea coast environment of Cape Kennedy where the shuttle will be launched. The CPI-4 was tested and the results gave a good indication of the type and degree of degradation to be expected in actual use. Author

N73-18573*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPLORATORY STUDY OF THE MICROSTRUCTURE OF MULLITE FIBERS
Gilbert J. Santoro, Hubert B. Probst, and Bruno C. Buzek Washington Mar. 1973 26 p refs
(NASA-TM-X-2750; E-7253) Avail: NTIS HC $3.00 CSCL 11D

Mullite fibers of three compositions, ranging from SiO_2-rich to Al_2O_3-rich, were investigated by a number of transmission electron microscopy (TEM) techniques. The fibers were examined in the as-received condition and after subjecting them to thermal exposures as high as 142 C. The investigative techniques used included direct TEM of microtomed sections of mounted fibers and TEM of replicas of polished, chemically etched, and cathodically etched fibers. In addition, X-ray diffraction line broadening analyses was used for determining average crystallite size. A preliminary description of the microstructure of mullite fibers is given. Author

N73-18574*# Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT OF PYRRONE STRUCTURAL FORMS FOR HONEYCOMB FILLER
B. C. Kimmel Washington NASA Mar. 1973 47 p refs
(Contract NAS1-10869)
(NASA-CR-2222; P72-294) Avail: NTIS HC $3.00 CSCL 11D

The development of techniques for the preparation of Pyrrone structural foams for use as honeycomb filler is described. The feasibility of preparing foams from polymers formed by the condensation of 3,3'-diaminobenzidine (DAB), or 3,3',4,4'-tetraaminobenzophenone (TABP), with 3,3',4,4'-benzophenone tetracarboxylic dianhydride (BTDA) was investigated. Initially, most of the effort was devoted to preparing Pyrrone prepolymers with improved and more reproducible foaming properties for making chemically blown foams. When it became apparent that very high curing shrinkages would not allow the use of unfilled Pyrrone prepolymers in a foam-in-place process, emphasis was shifted from chemically blown foams to syntactic foams. Syntactic foam formulations containing hollow carbon microspheres were developed. Syntactic foams made from selected formulations were found to have very low coefficients of thermal expansion. A technique was developed for the emplacement of Pyrrone syntactic foam formulations in honeycomb core structures. Author

N73-18575# Institut Franco-Allemand de Recherches, St. Louis (France).
OPTICAL MEASUREMENT OF THE DETONATION SPEED OF EXPLOSIVE MONOCRYSTALS ACCORDING TO THEIR CRYSTALLOGRAPHIC AXES. PART 1: RDX AND PETN [MESURE OPTIQUE DE LA VITESSE DE DETONATION DES MONOCRISTAUX D'EXPLOSIFS SUIVANT LEURS AXES CRISTALLOGRAPHIQUES. PREMIERE PARTIE: HEXOGENE ET PENTRITE]
H. W. Koch and C. Baras 25 Aug. 1971 32 p refs In FRENCH
(ISL-28/71-Pt-1) Avail: NTIS HC $3.75

The detonation speed of RDX and PETN monocrystals along their different crystallographic axes was investigated. The crystal preparation consists of density measurements and polyester coating. The treatment for visualization of the detonation wave is described. Data obtained by rotating mirror split camera recordings was processed by computer. The experimental results have revealed a weak anisotropy of detonation speed in the geometry. Author (ESRO)

N73-18576# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
CRACK INTERACTION [WECHSELWIRKUNG VON RISSEN]
M. Ratwani May 1972 47 p refs In GERMAN; ENGLISH summary
(WB-5/72) Avail: NTIS HC $4.50

The interaction between collinear and parallel cracks of the same length is considered in isotropic and layered composite materials. Numerical solutions for stress intensity factors for various symmetric crack arrangements are obtained based on the Navier-Stokes equations and a Fourier transformation, under symmetric loading for isotropic materials. For layered composites, symmetric and antisymmetric problems of two half-planes bonded to an elastic layer are considered. Author (ESRO)

N73-18577# Institut zur Erforschung Technologischer Entwicklungslinien, Hamburg (West Germany).
HEAVY DUTY FIBER REINFORCED COMPOSITE MATERIALS: FUTURE DEVELOPMENT AND APPLICATIONS [FASERVERSTAERKTE HOCHLEISTUNGS-VERBUNDWERKSTOFFE. ZUKUENFTIGE ENTWICKLUNG UND ANWENDUNG]
Rainer Taprogge, Rolf Scharwaechter, Peter Hahnel, Hans-Joachim Mueller, and Peter Steinmann 1972 229 p refs In GERMAN
Avail: NTIS HC $13.50; Niedersaechsische Buckdruckerei, Uelzen, West Ger. 30 DM

A state-of-the-art survey is presented of heavy duty composite materials for use in mechanically loaded structural elements, and reinforced metals and ceramics for use in thermally loaded structural parts. Development tendencies are discussed. Generally known and technically evaluated composites, such as glass fiber reinforced plastics are not treated comprehensively. The combination possibilities of new reinforcing materials with organic, metallic, and ceramic matrix systems and the possible future fields of application are discussed. A comparison is made of the properties of composites with conventional materials, and an estimation is given of future cost development. ESRO

N73-18578# Explosives Research and Development Establishment, Waltham Abbey (England).
THE APPLICATION OF DATA PROCESSING TO MECHANICAL TESTING. PART 2: COMPARISONS WITH CONVENTIONAL PRACTICE
B. L. Hammant May 1972 12 p ref
(ERDE-TR-111) Avail: NTIS HC $3.00

The variability of results from several observers making similar measurements of mechanical test data on polymers was examined. The measurement of the gradients of load/displacement curves exhibited the largest variations, up to + or - 13 percent between observers and up to + or - 7 percent between repeat measurements. The use of data processing is shown to eliminate these effects and improve the accuracy of recording. ESRO

N73-18579# Explosives Research and Development Establishment, Waltham Abbey (England).
THE APPLICATION OF DATA PROCESSING TO MECHANICAL TESTING. PART 3: FLEXURAL TESTS AND TENSILE TESTS ON RUBBERS
B. L. Hammant Aug. 1972 19 p refs
(ERDE-TR-114) Avail: NTIS HC $3.00

The use of data processing as an aid to the mechanical testing of rigid materials in flexure and rubbing materials in tension is described, together with the data reduction, flexural, and rubber test programs. Results obtained by the computer are in general agreement with those obtained by conventional means, but with improved accuracy and saving in time and effort. ESRO

N73-18580# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.
THE DEVELOPMENT OF COMPOSITE CARBON FIBRES OF LARGE DIAMETER: JUMBO FIBRES
G. A. Cooper, D. G. Gladman, J. M. Sillwood, and G. D. Sims Nov. 1972 35 p refs
(NPL-IMS-18) Avail: NTIS HC $3.75

The development of a process for manufacturing carbon fibers of larger diameter than those normally available from other

processes, is described. The method consists of impregnating a bundle of carbon fibers or their precursors with phenolic resin and after curing, subjecting the composite fiber to a controlled carbonisation. The end-product is a thin rod or fiber of carbon-fiber reinforced carbon, which can, in principle, have any desired cross-sectional shape or area. Experiments were conducted to discover the effect of various processing variables on the properties of the composite fiber. Having chosen a suitable resin for impregnation the principal variables are: the degree of pyrolysis of the initial fiber before impregnation, the rate of cure of the resin to form the intermediate and, the rate of temperature rise and the maximum temperature during the carbonization process. Fibers with reasonable toughness and compression strength were produced but improvements should be obtainable by optimization of this basic process. Author (ESRO)

N73-18581# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
[RESEARCH REPORTS IN MATERIALS SCIENCE AND SEMICONDUCTOR DEVICES] Annual Technical Report, Sep. 1971 - Sep. 1972
Nov. 1972 254 p refs
(Contract DAHC15-67-C-0222)
(AD-752063) Avail: NTIS CSCL 20/12

Contents: Chemical and solid state physics; Electronic, magnetic and optical properties of materials and device applications; Metallurgy and materials science; Materials engineering. Author (GRA)

N73-18582# Air Force Machinability Data Center, Cincinnati, Ohio.
[DATA FILES ON MACHINING OF MATERIALS] Annual Report, 1 Oct. 1971 - 31 Jul. 1972
Robert E. Snider Sep. 1972 30 p refs
(Contract F33615-71-C-1112; AF Proj. 8975)
(AD-752000; MDC-72-2; AMMRC-CTR-72-18; AR-8) Avail: NTIS CSCL 05/2

The center evaluated and processed an additional 2,148 technical documents on machining data and related topics. From these documents coded evaluations have resulted in keypunching of an additional 9,491 punched cards, which are in turn recorded on organized computer files. These computer files represent an automated index to a physical file of more than 30,000 individually coded documents. These documents represent 79,268 individual records such as the type of operation, speed, feed, condition, hardness, material group, etc. The results of a computer search on any given set of input parameters of these documents would result in an output listing of document file numbers which would facilitate manual retrieval of the specific hard copy documents from the physical file previously mentioned. Approximately 247 specific inquiries of this nature were answered for 156 different organizations representing 186 individuals. Statistics are presented of cost savings from MDC's services to it's users. Author (GRA)

N73-18583# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROMAGNETIC FIELD IN FIBER COMPOSITES
G. A. Van Fo Fy 16 Oct. 1972 30 p refs Transl. into ENGLISH from the book "Composite Fibrous Mater." Kiev, 1970 p 112-126
(AF Proj. 782)
(AD-752693; FTD-HT-23-1381-72) Avail: NTIS CSCL 11/4

The article includes: The Electrostatics of Reinforced Dielectrics; Permittivity in a weakly variable field; Magnetostatics of Reinforced Media; Electromagnetostatics of Dielectrics Reinforced with Composite and Hollow Fibers; Permittivities and Magnetic permeabilities of multi-component materials; Equations of the electromagnetic Field in Reinforced materials; High frequency in Media reinforced by conductors; Longitudinally Propagating Waves in Media Reinforced by conductors; and Electromagnetic Waves in Fibrous Dielectrics. Author (GRA)

N73-18584# Goodyear Aerospace Corp., Akron, Ohio.
DEVELOPMENT OF BALLISTIC-DAMAGE-TOLERANT FLIGHT CONTROL COMPONENTS MOLDED OF A SHORT-FIBER REINFORCED COMPOSITE MATERIAL. PHASE 1 SUMMARY REPORT: COMPOSITE MATERIAL FORMATION, EVALUATION, AND CHARACTERIZATION Summary Report, Jun. 1970 - Dec. 1971
Donald C. Cully, Robert V. Kolarik, T. J. Boller, and W. F. Conley Sep. 1972 276 p refs
(Contract DAAJ02-70-C-0062; DA Proj. 1F1-62203-A-150)
(AD-752918; GER-15518; USAAMRDL-TR-72-28) Avail: NTIS CSCL 11/9

The purpose of the program was to select and characterize the most efficient discontinuous fiber glass-epoxy composite for use in ballistically tolerant flight control components. The effects of various constituent parameters on the extent of damage and residual tensile load capacity were determined after tumbled caliber .30 ball M2 projectile impact at 0-degree obliquity and 1800 ft/sec. These parameters included fiber glass and resin types, interfacial properties, fiber length, and fiber content. The three most promising composites for further study were identified as 1-inch S-2 glass fibers in an epoxy novalac matrix, 1/2-inch S-2 glass fibers in an epoxy novalac matrix, and 1-inch E glass in a flexibilized epoxy matrix. Author (GRA)

N73-18585# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRICAL BREAKDOWN OF LIQUID DIELECTRICS (A REVIEW)
I. E. Balygin 20 Oct. 1972 19 p refs Transl. into ENGLISH from Elektrichestvo (USSR), no. 1, 1954 p 89-92
(AD-752819; FTD-HT-23-772-72) Avail: NTIS CSCL 11/7

The review is a comparison of different test data on liquid dielectric breakdown. It supports the assertion that only in certain particular cases is the liquid breakdown mechanism similar to the mechanism of gas. This mechanism is largely determined by the physical and chemical nature of the substance and by certain external factors, such as the form and material of the electrodes, the form of the applied voltage, and a few others. From this it follows that no unitary mechanism for the breakdown of liquid dielectrics exists, and therefore one can scarcely look for the creation of a breakdown theory which will be generally valid for all liquid dielectrics, regardless of their physical and chemical nature. Author (GRA)

N73-18586# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
ENVIRONMENT-SENSITIVE HARDNESS AND MACHINABILITY OF ALUMINA
Albert R. C. Westwood, Norman H. MacMillan, and Rustus Kalyoncu Jul. 1972 32 p refs
(Contract N00014-70-C-0330)
(AD-753276; RIAS-TR-72-24C; TR-6) Avail: NTIS CSCL 11/2

The influences of water, toluene and the n-alcohols on the pendulum hardness of alumina monocrystals, and on the ease of drilling mono- and polycrystalline alumina, have been studied. It has been found that the adsorption-induced increases in pendulum hardness produced by certain alcohol environments can result in rates of drilling with diamond-studded core bits which are up to ten times greater than those measured in tests under water. A correlation between pendulum hardness, machinability and surface charge (the latter as indicated by zeta-potential measurements) has been established. This is that alumina is hardest and most effectively drilled with a diamond core bit at its zero point of charge. The possibility of making use of this correlation to develop more cost effective and ecologically viable cutting fluids for the machining of aluminia is discussed. Author (GRA)

N73-18587# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERNAL STRESS FIELD AND ELASTIC MODULI OF FIBROUS COMPOSITIONS
G. A. Van Fo Fy 13 Oct. 1972 53 p refs Transl. into ENGLISH from the book "Vnutr. pole Napryazhi i Moduli Uprugosti Voloknistykh Kompozitsii" 1970 p 40-76
(AD-752866; FTD-HT-23-1330-72) Avail: NTIS CSCL 11/4

In order to simplify analysis of the internal stress field the general solution of the problem is divided into partial solutions, which correspond to the applied components of the external force field. The solutions in this article are, Longitudinal Shear Problem; Optimal Volume Concentration of Components for

Fibrous Compositions in the Case of Shear; Effect of the Type Microstructure on Composition Properties; Longitudinal Shear in Multicomponent Compositions; and, Transverse Shear in Fibrous Composition. Author (GRA)

N73-18588# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BENCH TESTS OF THE WEAR RESISTANCE AND ANTI-FRICTION PROPERTIES OF EPOXY COMPOUNDS

L. D. Efimov, V. A. Cherenkevich, and M. M. Koveshnikov 27 Oct. 1972 12 p Transl. into ENGLISH from Tr. Inst. Inzhen. Zheleznod. Trans., Omsk (USSR), v. 82, 1969 p 13-17

(AF Proj. 7343)

(AD-752868; FTD-HT-23-1020-72) Avail: NTIS CSCL 11/4

Of the epoxies tested, an epoxy composition based on ED-5 resin and containing 10% DI-BU phthalate, 10% polyethylene polyamine, 90% graphite, and 2% Al dust or 80% graphite and 5% Al dust, had the highest wear resistance and performance rating. Due to the low impact strength, lubricated bearings coated with the ED-5 resin compositions can operate at a maximum pressure of 10 KBF/sq cm at a sliding rate of 1.0-1.7 m/s. Author (GRA)

N73-18589# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

OPTIMAL DESIGN OF LOCALLY ORTHOTROPIC ELASTIC FLAT BODIES WITH WEAK BINDING

G. I. Bryzgalin 17 Nov. 1972 20 p refs Transl. into ENGLISH from Inzh. Zh., Mekh. Tverd. Tela (Moscow), no. 3, 1971 p 169-175

(AF Proj. 1369)

(AD-753040; FTD-HT-23-1245-72) Avail: NTIS CSCL 11/4

Optimal design of elastic bodies made of fiberglass reinforced plastics or metals reinforced by fibers with a high elasticity modulus is discussed. It is assumed that the composite components are in a plane strain or a plane stress state and that the reinforcement is directed along two mutually orthogonal families of plane curves. The equations of these curves and the reinforcement level at each point of the bulk body are determined for a given boundary profile and specified conditions existing on this boundary. Author (GRA)

N73-18590# TRW, Inc., Cleveland, Ohio.

THE TIME DEPENDENT MECHANICAL BEHAVIOR OF METAL MATRIX COMPOSITES Final Report, 1 Apr. 1971 - 31 Mar. 1972

Scott T. Scheirer, Istvan J. Toth, and George D. Menke Sep. 1972 105 p refs

(Contract F33615-71-C-1501; AF Proj. 7351)

(AD-753706; TRW-ER-7274-7; AFML-TR-72-149) Avail: NTIS CSCL 11/4

The objectives were to investigate the time dependent mechanical behavior of boron filament reinforced aluminum composites and to characterize the static and dynamic properties of B/SiC filament reinforced Ti(6Al-4V) composites. Author (GRA)

N73-18591# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.

DAMPING CHARACTERISTICS OF FIBER COMPOSITES

Zvi Hashin Jul. 1972 36 p refs Presented at 8th Intern. Council of the Aeron. Sci. (ICAS) Congr., Amsterdam, 28 Aug. - 2 Sep. 1972

(Contract F44620-71-C-0100; AF Proj. 9782)

(AD-753699; MED-36; Scientific-1; AFOSR-72-2327TR) Avail: NTIS CSCL 11/4

Analytical results for complex moduli of uniaxially fiber reinforced materials made of viscoelastic matrix and elastic fibers are reviewed. A general method is established to predict complex moduli and loss tangents of viscoelastic laminates made of uniaxially reinforced laminae. Results are used to analyze some simple cases of vibrations of structures made of such viscoelastic composites. Author (GRA)

N73-18592# Aerospace Corp., El Segundo, Calif. Lab. Operations.

A LABORATORY METHOD FOR THERMAL FRACTURE OF GRAPHITE Technical Report, Dec. 1972 - May 1972

Hans U. Eckert 31 Oct. 1972 42 p refs

(Contract F04701-72-C-0073)

(AD-753392; TR-0073(3450-76)-1; SAMSO-TR-72-275) Avail: NTIS CSCL 11/2

A method was developed for producing thermal stress failure in ATJ-S graphite and the initial results are described. Test specimens are 10-cm-long hollow cylinders with outer and inner radii of 1.9 and 0.4 cm, respectively. The outside is heated by induction at a frequency of 1.4 MHz by a 100-kW power oscillator; the inside is kept below 100C by forcing water at a rate of 5 gpm through the copper-coated bore. A special lead soldering technique has been developed to fasten the coolant ducts to the specimen. The inductor coil is protected by an oil bath against heat and electric breakdown. Author (GRA)

N73-18593# Whittaker Corp., West Concord, Mass. Nuclear Metals Div.

DEVELOPMENT OF SUPERALLOY MATRIX-REFRACTORY METAL FIBER COMPOSITES COEXTRUSION OF BLENDED POWERS

Jacob Greenspan and F. J. Rizzitano Watertown, Mass. Army Mater. and Mech. Res. Center Sep. 1972 22 p

(Contract DAAG46-71-C-0148; DA Proj. 1T0-61101-A-91A)

(AD-753340; AMMRC-TR-72-29) Avail: NTIS CSCL 11/4

Fibers of molybdenum, TZM molybdenum, and tungsten were incorporated within a matrix of four different superalloys by extruding mixtures of spherical powders. Process feasibility, being a function of the flow characteristics of the coexisting materials, occurred only with certain materials, and at certain extrusion temperature. In these cases, fiber aspect ratios were sufficient, theoretically, to obtain fiber strengthening. Author (GRA)

N73-18594# Battelle Columbus Labs., Ohio.

CONDUCTIVE, LUSTERLESS COATINGS FOR LIGHT METALS Final Report, 1 Mar. - 31 Aug. 1972

C. H. Layer, G. R. Schaer, J. G. Beach, and W. H. Safranek Dec. 1972 43 p refs

(Contract DAAB07-72-C-0122; DA Proj. 1T0-62105-A-348)

(AD-753360; ECOM-0122-F) Avail: NTIS CSCL 11/3

A metallic conductive, lusterless plating system with improved corrosion durability developed for aluminum was the basis for a program on the improvements of the corrosion durability of magnesium. A composite of electroplates containing either a fused tin or a cobalt-nickel alloy was effective for inhibiting corrosion pits from penetrating through the coating into the magnesium substrates. The efficacy of the coating was not completely demonstrated because of inconsistent quality (adhesion) of copper strike on magnesium, however. A technique proposed for improving the quality of the copper strike includes a cyanide treatment after the application of a zinc displacement coating on magnesium, to improve the adhesion of the subsequent copper strike. Author (GRA)

N73-18595# Illinois Inst. of Tech., Chicago. Dept. of Metallurgical and Materials Engineering.

IMPACT STRENGTH AND TOUGHNESS OF FIBER COMPOSITE MATERIALS

Lawrence J. Broutman and Assa Rotem Nov. 1972 56 p refs

(Grant AF-AFOSR-2214-72; AF Proj. 9782)

(AD-753101; AFOSR-72-2289TR; TR-1) Avail: NTIS CSCL 11/4

The energy absorption capability of glass fiber and carbon fiber composites has been studied by performing instrumented drop weight impact tests on beams. A drop weight impact machine was designed and built for this purpose. The strength and energy absorption of the composite beams has been measured as a function of impact velocity, impact mass, beam geometry, and also as a function of several composite material parameters. Author (GRA)

N73-18596# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN EXPERIMENTAL STUDY OF THE HYDRODYNAMICS OF FIBER FORMATION IN A TUBE

Yu. A. Vinogradov and V. D. Fikhman 27 Oct. 1972 16 p refs Transl. into ENGLISH from Khim. Volokna (Leningrad), no. 3, 1971 p 8-11

(AF Proj. 7343)
(AD-753032; FTD-HT-23-974-72) Avail: NTIS CSCL 11/5

The fiber formation theory (Vinogradov, Yu. A.; Fikhman, V. D., 1971) from poly(vinyl chloride) dimethyl formamide solutions in a tube filled with water was verified by experiment. As predicted the increase in the number of the spinneret orifices increased the diameter of the coagulating stream entrained by the fibers. The calculated pressure drops along the coagulating tube and the hydraulic velocity gradients agreed well with the experimental values. Author (GRA)

N73-18597# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
ALLOYING AND THERMAL TREATMENT OF CERAMICS Final Report, 1 Jun. 1968 - 30 Sep. 1972
Morris E. Fine, Jerome B. Cohen, and D. Lynn Johnson 30 Nov. 1972 18 p refs
(Grant AF-AFOSR-1457-68; AF Proj. 9763)
(AD-753124; AFOSR-72-2108TR) Avail: NTIS CSCL 11/2

The object of the research was to provide basic information which would be useful for the technology of alloying and thermal treatment of ceramics. Specifically, magnesioferrite precipitates gave substantial strengthening to magnesium oxide. Magnetite precipitates in wustite, iron in iron oxide, and zirconium in zirconia increased both fracture initation energy and fracture strength. Spinodal decomposition was found in cobalt ferrite-cobalt oxide system. Material with very high coercive force resulted.
Author (GRA)

N73-18598# Minnesota Univ., Minneapolis. Dept. of Aeronautics and Engineering Mechanics.
DAMPING IN PORCELAIN ENAMEL COATINGS Summary Technical Report, Jun. 1969 - Jun. 1971
Prabha Sridharan and Robert Plunkett Jul. 1972 80 p refs
(Contract F33615-69-C-1240; AF Proj. 7351)
(AD-752317; AFML-TR-71-193) Avail: NTIS CSCL 11/3

Porcelain enamels are extensively used as protective and decorative coatings for metal parts. This report describes a study of the damping capability of these coatings at elevated temperatures. A maximum loss coefficient of .04 was observed for a bending specimen of mean thickness 0.09 inches, with a .0055 inch thick porcelain enamel coating. Experimental data showing the dependence of damping on temperature, coating thickness and frequency is presented. A method for determining the complex elastic modulus of the coating material is discussed. Results from bending and torsion experiments are compared.
Author (GRA)

N73-18599# Commonwealth Scientific Corp., Alexandria, Va.
IMPROVEMENT OF INTERLAMINAR SHEAR STRENGTH IN ORGANIC MATRIX COMPOSITES UTILIZING PLASMA DEPOSITED COUPLING AGENTS Final Technical Progress Report, 1 Apr. 1971 - 30 Apr. 1972
A. P. Duhamel and Lee D. Nelson 30 Apr. 1972 119 p refs
(Contract N00017-70-C-4439)
(AD-753857) Avail: NTIS CSCL 11/4

Experimental work has been concerned primarily with the improvement of interlaminar shear strengths in organic matrix composites using plasma deposited coupling agents. An extremely efficient cleaning process for graphite fibers has been developed using a 2450 MHz plasma. It also appears that unsaturated coupling agents can be used satisfactorily to deposit polymeric materials on the fibers using a 450 KHz plasma. Preliminary data are presented using these two processes. The tensile strengths of NOL rings made of an epoxy matrix and graphite fiber reinforced using different process variables are presented. The two coupling agents studied were ethanol amine and acetylene. GRA

N73-18600# Connecticut Univ., Storrs. Dept. of Metallurgy.
FATIGUE BEHAVIOR IN TORSION OF AN UNIDIRECTIONALLY SOLIDIFIED EUTECTIC
W. G. Ovens, Jr. and A. J. McEvily, Jr. Oct. 1972 14 p refs
(Contract F44620-69-C-0011; AF Proj. 9560)
(AD-753689; UC-MET-10-72; AFOSR-72-2347TR) Avail: NTIS CSCL 11/4

The fatigue behavior of the directionally-solidified eutectic-alloy Al-Al3Ni was studied under cyclic-torsional loading. The fatigue process is largely confined to the matrix, with the rod-like reinforcing phase influencing the crack path. Grain boundaries are found to be preferred sites for cracking. An observed cyclic softening process is related to the initial distribution of dislocations along the fibers. A surface wrinkling effect is the result of a second-order effect in cyclic torsion. Fatigue properties of the composite are better than might be expected on the basis of axial tests. Author (GRA)

N73-18601# Midwest Research Inst., Kansas City, Mo.
VAPORIZATION KINETICS AND THERMODYNAMICS OF GRAPHITE USING THE HIGH PRESSURE MASS SPECTROMETER Final Technical Report, 1 Jun. 1971 - 31 May 1972
Thomas A. Milne, Jacob E. Beachey, and Frank T. Greene Wright-Patterson AFB, Ohio AFML Dec. 1972 77 p refs
(Contract F33615-71-C-1577; AF Proj. 7360; MRI Proj. 3518-C)
(AD-753713; AFML-TR-72-227) Avail: NTIS CSCL 11D

A brief review of current studies of the vaporization of graphite is presented, followed by a detailed description of our own work. Apparatus improvements are described, which allow heating of all-graphite Knudsen cells to about 3300K in vacuum without significant heating of beam system walls or objectionable outgassing. A continuously operating vacuum viewport and automatic pyrometer system is described for temperature monitoring under rapid window darkening vaporization conditions. Preliminary equilibrium ion ratio measurements are presented for the species C1 - C7 at temperatures up to 3300K. Extensive experimental results are presented on the neutral time-of-flight behavior of both carbon and low temperature gaseous species, using both the Nuclide and the Bendix mass spectrometers.
Author (GRA)

N73-18602# Watervliet Arsenal, N.Y. Benet Weapons Lab.
ELASTIC CONSTANTS OF SOME FIBER-REINFORCED MATERIALS
Yean Fu. Cheng Aug. 1972 29 p refs
(DA Proj. 1T0-62105-A-349)
(AD-753575; WVT-7243) Avail: NTIS CSCL 11/4

Elastic constants were determined, experimentally and analytically, for some fiber-reinforced composite materials including boron-aluminum, boron-epoxy, and fiberglas-epoxy. In total, ten combinations of fiber volume fraction and lamina orientation were investigated. Experimental values were obtained by means of electric resistance wire strain gages, analytical results from the Halpin-Tsai equations, and the laminate constitutive equations. Author (GRA)

N73-18603# Air Force Systems Command, Wright-Patterson AFB, Ohio. Transl. into ENGLISH from the mono. "Vsesoyuznogo Soves hchaniya po Tseolitam Materialy" Moscow, Izd-vo Nauka, 1965 p 83-87
INVESTIGATION OF DIELECTRIC RELAXATION OF ZEOLITE NaA DURING ABSORPTION OF WATER
B. A. Glazun, M. M. Dubinin, I. V. Zhilenkov, and V. M. Fedorov 24 Nov. 1972 13 p refs
(AD-753512; FTD-MT-24-1025-72) Avail: NTIS CSCL 07/4

A study has been made on the behavior of the dielectric constant and loss factor of zeolite NaA with various degrees of hydration and a change in temperature and frequency. Three areas of dielectric constant were established. Author (GRA)

N73-18604# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VISCOSITY AND ELECTRICAL CONDUCTIVITY OF MOLTEN GLASSES OVER A WIDE TEMPERATURE RANGE
R. S. Saringyulyan, K. A. Kostanyan, and E. A. Erznkyan 17 Nov. 1972 13 p refs Transl. into ENGLISH from Stekloobraznoe Sostoyanie (USSR), v. 5, no. 1, 1970 p 209-213
(AF Proj. 7343)
(AD-753480; FTD-HT-23-1101-72) Avail: NTIS CSCL 11/2

Experimental data indicate the absence of a rectilinear relationship between log sigma (electrical conductance) and log eta (viscosity). This correlation holds good in the high temperature regions. The values of n and C (constants in Littleton equation log eta + n log sigma = C) for different glasses are presented. Glasses become inhomogeneous in anomalous temperature

regions. At firing temperature regions the correlation between sigma and eta develop an exponential function. Author (GRA)

N73-18605# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NUCLEAR THERMAL VULNERABILITY OF HONEYCOMB RADOME MATERIALS M.S. Thesis
Michael V. Bell Dec. 1972 86 p refs
(AD-753666; GNE/PH/73-1) Avail: NTIS CSCL 17/9

The thermal vulnerability levels of honeycomb sandwich radome panels were determined by using quartz iodide lamps to irradiate the panels in a wind tunnel the lamps and wind tunnel simulated a thermal pulse on a flying aircraft. The radome panels were tested with lampblack, neoprene, and polyurethane coatings. Peak flux and 94.3 cal/sq cm total fluence. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-18606*# Georgia Univ., Athens. Dept. of Mathematics.
STATIONARY CONDITIONS FOR STOCHASTIC DIFFERENTIAL EQUATIONS
G. Adomian and W. W. Walker [1972] 57 p refs
(Grant NGR-11-003-020)
(NASA-CR-130779) Avail: NTIS HC $5.00 CSCL 12A

This is a preliminary study of possible necessary and sufficient conditions to insure stationarity in the solution process for a stochastic differential equation. It indirectly sheds some light on ergodicity properties and shows that the spectral density is generally inadequate as a statistical measure of the solution. Further work is proceeding on a more general theory which gives necessary and sufficient conditions in a form useful for applications. Author

N73-18607*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
COMPUTATION OF OPTIMAL OUTPUT-FEEDBACK COMPENSATORS FOR LINEAR TIME-INVARIANT SYSTEMS
Loren K. Platzman Aug. 1972 50 p refs
(Grant NGL-22-009-124)
(NASA-CR-130988; ESL-R-488) Avail: NTIS HC $4.50 CSCL 12A

The control of linear time-invariant systems with respect to a quadratic performance criterion was considered, subject to the constraint that the control vector be a constant linear transformation of the output vector. The optimal feedback matrix, f^*, was selected to optimize the expected performance, given the covariance of the initial state. It is first shown that the expected performance criterion can be expressed as the ratio of two multinomials in the element of f. This expression provides the basis for a feasible method of determining f^* in the case of single-input single-output systems. A number of iterative algorithms are then proposed for the calculation of f^* for multiple input-output systems. For two of these, monotone convergence is proved, but they involve the solution of nonlinear matrix equations at each iteration. Another is proposed involving the solution of Lyapunov equations at each iteration, and the gradual increase of the magnitude of a penalty function. Experience with this algorithm will be needed to determine whether or not it does, indeed, possess desirable convergence properties, and whether it can be used to determine the globally optimal f^*. Author

N73-18608*# Brown Univ., Providence, R.I. Center for Dynamical Systems.
A STABILITY ANALYSIS FOR A SEMILINEAR PARABOLIC PARTIAL DIFFERENTIAL EQUATION
Nathaniel Chafee Jan. 1973 28 p refs
(Grants NGL-40-002-015; DA-ARO(D)-31-124-71-G12)
(NASA-CR-130542) Avail: NTIS HC $3.50 CSCL 12A

The parabolic partial differential equation considered is u sub t = u sub xx + f(u), where minus infinity < x plus infinity and o < t < plus infinity. Under suitable hypotheses pertaining to f, a class of initial data is exhibited: phi(x), minus infinity < x < plus infinity, for which the corresponding solutions u(x,t) appraoch zero as t approaches the limit of plus infinity. This convergence is uniform with respect to x on any compact subinterval of the real axis. Author

N73-18609# Joint Publications Research Service, Arlington, Va.
CYBERNETICS AND REGULATION THEORY
26 Jan. 1973 27 p refs Transl. into ENGLISH of Dokl. Akad. Nauk SSSR (Moscow), v. 205, no. 4, 1972 p 787-790, 1061-1067, 1309-1312
(JPRS-58069) Avail: NTIS HC $3.50

Articles on linearizable objects and their application in differential games of pursuit, multidimensional Laplace-Galois transformation in the theory of nonlinear sequential machines, variational problems in optimization for hyperbolic partial differential equations, and a spectral approach to the comparison of objects characterized by a set of signs. For individual titles, see N73-18610 through N73-18613.

N73-18610 Joint Publications Research Service, Arlington, Va.
LINEARIZABLE OBJECTS AND THEIR APPLICATION IN DIFFERENTIAL GAMES OF PURSUIT
M. S. Nikolskiy *In its* Cybernetics and Regulation Theory 26 Feb. 1973 p 1-7 refs (For availability see N73-18609 09-19)

Theorems are proved concerning the motion of vectors in an n-dimensional space. The limitations are defined and the conditions for linearizability are delineated. Examples are given for motion of the controlled objects described by different differential equations. N.E.N.

N73-18611 Joint Publications Research Service, Arlington, Va.
MULTIDIMENSIONAL LAPLACE-GALOIS TRANSFORMATION IN THE THEORY OF NONLINEAR SEQUENTIAL MACHINES
A. S. Bernshteyn, Yu. S. Popkov, and R. G. Faradzhev *In its* Cybernetics and Regulation Theory 26 Jan. 1973 p 8-12 refs (For availability see N73-18609 09-19)

A multidimensional Laplace-Galois transform is defined which describes nonlinear sequential machines of an arbitrary type with characteristics analogous to those of linear sequential machines. A nonlinear sequential machine is an analog of a pulsed dynamic system if all processes within it assume values in the final set and all operations are determined over a specific field. Transfer functions are given which characterize a sequential connection, a parallel connection with outputs summed, and a parallel connection with outputs multiplied. N.E.N.

N73-18612 Joint Publications Research Service, Arlington, Va.
VARIATIONAL PROBLEMS IN OPTIMIZATION FOR PARTIAL DIFFERENTIAL EQUATIONS OF A HYPERBOLIC TYPE
L. V. Petukhov and V. A. Troitskiy *In its* Cybernetics and Regulation Theory 26 Jan. 1973 p 13-17 refs (For availability see N73-18609 09-19)

Hyperbolic equations and correlations in a two-dimensional region and defined by inequalities are examined. Initial and boundary conditions, the problem of optimization and continuous controls, and calculation and analysis of the variation in the two-dimensional region are described. The necessary Weierstrass condition of a strong minimum of the functional J is formulated, and problems of optimal dynamic loading of a string are solved. N.E.N.

N73-18613 Joint Publications Research Service, Arlington, Va.
A SPECTRAL APPROACH TO THE COMPARISON OF OBJECTS CHARACTERIZED BY A SET OF SIGNS
Yu. L. Vasilyev and A. N. Dmitriyev *In its* Cybernetics and Regulation Theory 26 Jan. 1973 p 18-24 refs (For availability see N73-18609 09-19)

A numerical method of refining a diagnostic procedure is given. A numerical measure of objects and signs characterizing the objects is introduced, and an iterative method for calculating the measure is described. Applications are made to geological surveys for petroleum, copper, and nickel deposits. N.E.N.

N73-18614*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMUM ALLOCATION OF REDUNDANCY AMONG SUBSYSTEMS CONNECTED IN SERIES Ph.D. Thesis - Case Western Reserve Univ., Sep. 1970
Darl D. Bien Washington Mar. 1973 74 p refs
(NASA-TN-D-7164; E-5808) Avail: NTIS HC $3.00 CSCL 12A

This analysis considers the optimum allocation of redundancy in a system of serially connected subsystems in which each subsystem is of the k-out-of-n type. Redundancy is optimally allocated when: (1) reliability is maximized for given costs; or (2) costs are minimized for given reliability. Several techniques are presented for achieving optimum allocation and their relative merits are discussed. Approximate solutions in closed form were attainable only for the special case of series-parallel systems and the efficacy of these approximations is discussed. Author

N73-18615*# Linguistic Systems, Inc., Cambridge, Mass.
OSCILLATION AND NONOSCILLATION CONDITIONS FOR CANONIC LINEAR SETS OF DIFFERENTIAL EQUATIONS
V. A. Yakubovich Washington NASA Feb. 1973 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 124, no. 5, 1959 p 994-997
(Contract NASw-2482)
(NASA-TT-F-14816) Avail: NTIS HC $3.00 CSCL 12A

Eight theorems are presented regarding oscillation and nonoscillation criteria for several differential equations. Criteria for both scalar and vector equations are presented. Author

N73-18616# National Aerospace Lab., Tokyo (Japan).
A MATHEMATICAL THEORY OF THE EVALUATION OF OBSERVATION SYSTEMS
Takeo Kimura 1972 16 p refs In JAPANESE; ENGLISH summary
(NAL-TR-301) Avail: NTIS HC $3.00

This investigation shows how observation systems should be defined as better or best quantitatively. On the basis of this theory, the best observation system can be found by means of only a numerical calculation. It should be noted that the word better or best has the meaning of certainty or accuracy. In the case in which the unknown state to be obtained by observation is represented by only one variable, the certainty or accuracy of the state is obvious. But in cases in which the unknown state is represented by many variables, the certainty or accuracy has been ambiguous in recent theories. The theory in this report is effective in the latter case. The certainty or accuracy in the case of many variables is usually represented by the evaluation functions of quadratic form. However, it would be incorrect, as is mathematically verified in this report, if the evaluation function were represented by the so-called generalized variance, which is not of quadratic but of determinant form. Author

N73-18617# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
NUMERICAL SOLUTION OF INITIAL VALUE PROBLEMS WHOSE SOLUTION IS KNOWN IMPLICITLY
E. Wasserstrom May 1972 28 p refs
(TAE-152) Avail: NTIS HC $3.50

Numerical solution of various problems by the method of continuation is achieved by reformulating these problems as initial-value ones. The peculiar property of these initial-value problems is that their implicit solution is known. Data show how to take advantage of this information in the case of finding roots of polynomials and of solving eigenvalue problems. Author

N73-18618# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
AN APPROXIMATE ANALYTICAL SOLUTION OF THE REYNOLDS EQUATION
M. J. Cohen and O. Pinkus Jun. 1972 45 p refs
(TAE-153) Avail: NTIS HC $4.25

An analytical solution of the Reynolds Equation is given in the form of an infinite trigonometric series with constant coefficients. A finite number of these suffices to yield accurate solutions. These coefficients can be obtained from a solution of an ordinary set of simultaneous algebraic equations. Specific solutions for load, flow and friction are written for both slider and journal bearings, and these compare favorably with available exact computer solutions. Author

N73-18619# Lockheed Missiles and Space Co., Palo Alto, Calif.
CORRELATION PROPERTIES OF GAUSSIAN RANDOM PROCESSES UNDER NONLINEAR TRANSFORMATIONS
V. I. Vinokurov and R. A. Vakker [1972] 4 p Transl. into ENGLISH from the book "Voprosy Obrabotki Slozhnykh Signalov v Korreliatsionnykh Sistemakh" Moscow, Sovetskoe Radio, 1972 p 31-35
Avail: NTIS HC $3.00; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The probability that nonlinear transformations of random processes will result in a change in the mutual correlation function is investigated. Particular note is made of the influence of nonlinear transformations on the correlation function of random processes with zero mean values. J.M.M.

N73-18620*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A UNIFIED DEVELOPMENT OF SEVERAL TECHNIQUES FOR THE REPRESENTATION OF RANDOM VECTORS AND DATA SETS
W. Thomas Bundick Washington Mar. 1973 46 p refs
(NASA-TR-R-398; L-8490) Avail: NTIS HC $3.00 CSCL 12A

Linear vector space theory is used to develop a general representation of a set of data vectors or random vectors by linear combinations of orthonormal vectors such that the mean squared error of the representation is minimized. The orthonormal vectors are shown to be the eigenvectors of an operator. The general representation is applied to several specific problems involving the use of the Karhunen-Loeve expansion, principal component analysis, and empirical orthogonal functions; and the common properties of these representations are developed. Author

N73-18621# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
AN ALGORITHM FOR INTEGER LINEAR PROGRAMS USING INTERSECTIONS AND PROJECTIONS ON N-SIMPLEXES. PART 1
E. R. Brocklehurst Jul. 1972 49 p refs
(NPL-NAC-20-Pt-1) Avail: NTIS HC $4.50

An algorithm for solving the pure integer linear programming problem is described. The algorithm is designed to take advantage of any approximate solution that is available in order to obtain successively tighter bounds on the variables and objective function. The algorithm deals in a natural way with equality constraints and may easily be extended to solve the mixed integer problem. Three problems from the literature are solved by way of examples. Author (ESRO)

N73-18622# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
THE IMPLEMENTATION OF TWO MODIFIED NEWTON ALGORITHMS FOR UNCONSTRAINED OPTIMIZATION
P. E. Gill, W. Murray, and S. M. Picken Aug. 1972 69 p refs
(NPL-NAC-24) Avail: NTIS HC $5.50

A new modified Newton procedure was presented for the solution of a minimization problem of F(x) where F(x) is a nonlinear function with gradient vector and Hessian matrix. The new procedure requires a subroutine for the calculation of F(x) and its first and second derivatives at any point in E(n). An ALGOL 60 subroutine implementing the new method together with the necessary alterations required to implement the variant, so as to deal with the case where analytical second derivatives are unavailable is described. The results of applying these procedures to a number of test problems are included. Author (ESRO)

N73-18623# Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).
METHOD OF ADJUSTING LINEAR AND NONLINEAR CLASSIFIERS [EINSTELLVERFAHREN FUER LINEARE UND NICHTLINEARE KLASSIFIKATOREN]
W. Zorn Bonn Bundeswehramt 1972 183 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-72-5) Avail: NTIS HC $11.25

The problem of adjusting the parameters of a classifer so that a given pattern set is recognized correctly, is treated as that of transducing a closed-loop adaptive system from an arbitrary initial state into a solution state, which is defined by the maximum of a gain function. The adaptive system consists of an adjustable threshold classifier preceded by a Boolean network, an adjustment unit, and an evaluation unit which calculates the gain function. Training algorithms are suitable for solving a great variety of problems which are described and interpreted as interactions between these units. Examples from threshold logic demonstrate both the linear and the nonlinear methods; results of practical pattern recognition problems are also discussed. Author (ESRO)

N73-18624# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft - und Raumfahrtkonstruktionen.

THE HYPERMATRIX QR FACTORIZATION. A HYPERMATRIX GENERALIZATION OF HOUSEHOLDER'S METHOD

O. E. Broenlund and T. L. Johnsen 1971 11 p ref

(ISD-112) Avail: NTIS HC $3.00

A method is developed for storing coefficient matrices of linear equations systems in a computer. A hypermatrix storage scheme is proposed in which the matrix is split into submatrices, and pivoting for size is possible by using a Gaussian transformation, which is time consuming. A numerically stable hypermatrix algorithm is then developed by generalizing the triangularization method of Householder, which is compatible with hypermatrix storage schemes. These tools were also applied to the reduction of a symmetric matrix to a banded form and nonsymmetric matrices to hyper-Hessenberg form by orthogonal similarity transformations. In each major step of reduction, the orthogonal matrix is determined analogous to a step in the hyper-QR process. The algorithm also presents a stable and computer-compatible method for the orthogonalization of a set of hyper-columns.

ESRO

N73-18625# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

TWO METHODS FOR THE SOLUTION OF LINEARLY CONSTRAINED AND UNCONSTRAINED OPTIMIZATION PROBLEMS

P. E. Gill and W. Murray Nov. 1972 60 p refs

(NPL-NAC-25) Avail: NTIS HC $5.00

Two numerically stable algorithms are presented for the solution of unconstrained optimization problems. These algorithms have clearly defined advantages over alternative methods and the class of problems on which they should be used in preference to other algorithms is identified. The generalization of the algorithms to the linearly constrained problem handles constraints in an identical manner to that given for linear programming and quadractic programming. The formulation of various basic factorizations is considered and how these are modified from iteration to iteration, discussed. These factorizations could be implemented into both existing algorithms for linearly constrained optimization problems and any new algorithm that may arise.

Author (ESRO)

N73-18626# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

THE NUMERICAL SOLUTION OF A PROBLEM IN THE CALCULUS OF VARIATIONS

P. E. Gill and W. Murray Nov. 1972 42 p refs

(NPL-NAC-28) Avail: NTIS HC $4.25

Two algorithms are presented for the solution of a problem in the calculus of variations, the first requiring knowledge of the first and second variation and the second requiring only the first variation. These algorithms require a very small amount of storage and utilize the most powerful methods for unconstrained optimization that are currently available. They can be shown to be convergent to a strong local minimum of a wide class of functions and the initial approximation to the solution can be arbitrary, providing the objective function is twice continuously differentiable. Although there have been other algorithms which minimize storage requirements they have not been linked with a powerful optimization procedure. Finally, an outline of a method for more difficult problems in optimal control is given which satisfies similar properties to those described above.

Author (ESRO)

N73-18627*# California Univ., Berkeley. Research Center.

SOME INEQUALITIES FOR CERTAIN FUNCTIONS OF ORDER STATISTICS FROM IFR DISTRIBUTIONS

Robert A. Brown and Nozer D. Singpurwalla Aug. 1972 25 p refs Prepared in cooperation with George Washington Univ., Washington

(Grant NGL-09-010-030; Contracts N00014-69-A-0200-1; N00014-67-A-0214-0001; NR Proj. 042-238)

(NASA-CR-130962; AD-749040; ORC-72-18) Avail: NTIS HC $3.25 CSCL 12A

In the paper the authors consider functions which are the sum of the k largest order statistics in a sample of size n from a continuous distribution F, minus nh, where h is a specified constant. If F is an exponential distribution, then for a specified value of k the authors obtain that value of n which maximizes the expected value of the function defined above. If F is IFR then the authors obtain an upper bound on that value of n which maximizes the expected value of the function (for a specified value of k), and also an upper bound on the maximum of the expected value of the function. Some other inequalities are also obtained.

Author (GRA)

N73-18628# Wisconsin Univ., Madison. Mathematics Research Center.

GRADIENT METHODS FOR DUAL OPTIMAL CONTROL AND MAX-MIN PROBLEMS Technical Summary Report

Earl R. Barnes Sep. 1972 31 p refs

(Contract DA-ARO(D)-31-124-46-2)

(AD-753129; MRC-TSR-1127) Avail: NTIS CSCL 12/1

The author considers two max-min problems. The first problem arises in optimal control theory when duality is used to reduce certain problems having a large number of nonlinear constraints to a sequence of problems, each having only one nonlinear constraint. The second problem is a variational problem for determining the optimum taper of a cooling fin. The principal aim is to describe and prove convergence of certain gradient procedures for solving these problems numerically.

Author (GRA)

N73-18629# Hawaii Univ., Honolulu. Dept. of Information and Computer Science.

THE APPLICATION OF TECHNIQUES OF MATHEMATICAL STATISTICS TO TIME SERIES ANALYSIS AND STATISTICAL METEOROLOGY Final Status Report, 1 Oct. 1968 - 28 Sep. 1972

Richard H. Jones 28 Sep. 1972 8 p refs

(Contract F44620-69-C-0035)

(AD-753714; AFOSR-72-2322TR) Avail: NTIS CSCL 12/1

The major effort of the contract has been the development of practical statistical prediction techniques including the identification of the proper variables to be included in the prediction model. The research of this contract is divided into three main groups: Chang detection techniques for stationary time series; Other results in time series analysis. This research includes estimation of coherence between two time series when the phase is rapidly changing, recursive estimation of regression parameters, estimation of the spectral density with unequally spaced or missing meteorological observations; Statistical meteorology. This research includes meteorological prediction and forecasting, statistical methods using unequally spaced aircraft observations, and atmospheric pollution effect on rainfall trends.

Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-18630*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

OBJECTIVE SEA LEVEL PRESSURE ANALYSIS FOR SPARSE DATA AREAS

Leonard M. Druyan Oct. 1972 41 p refs Sponsored in part by NAS-NRC

(NASA-TM-X-69135) Avail: NTIS HC $4.25 CSCL 04B

A computer procedure was used to analyze the pressure distribution over the North Pacific Ocean for eleven synoptic times in February, 1967. Independent knowledge of the central pressures of lows is shown to reduce the analysis errors for very sparse data coverage. The application of planned remote sensing of sea-level wind speeds is shown to make a significant contribution to the quality of the analysis especially in the high gradient mid-latitudes and for sparse coverage of conventional observations (such as over Southern Hemisphere oceans). Uniform distribution of the available observations of sea-level pressure and wind velocity yields results far superior to those derived from a random distribution. A generalization of the results indicates that the average lower limit for analysis errors is between 2 and 2.5 mb based on the perfect specification of the magnitude of the sea-level pressure gradient from a known verification analysis. A less than perfect specification will derive from wind-pressure relationships applied to satellite observed wind speeds. Author

N73-18631# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY NO. 11, NOVEMBER 1972
19 Jan. 1973 126 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 11, Nov. 1972 p 3-57, 67-107 (JPRS-58025) Avail: NTIS HC $8.50

Meteorological and hydrological research over and in oceans is reviewed. The research included intratropical convergence zone in eastern Pacific Ocean, models of extremal Arctic winter atmosphere, quasi-biannual cycle of the Indian Ocean, and wind-driven currents with bottom slipping in shallow water. For individual titles, see N73-18632 through N73-18642.

N73-18632 Joint Publications Research Service, Arlington, Va.
SOME RESULTS OF RESEARCH BY THE COMPLEX ATMOSPHERIC ENERGETICS EXPERIMENT PROGRAM (1970-1972)
K. Ya. Kondratyev, O. B. Vasilyev, V. F. Zhvalev, S. P. Malevskiy-Malevich, L. R. Orlenko, and N. Ye. Ter-Markaryants *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 1-14 refs (For availability see N73-18631 09-20)

The complete radiation experiment was realized. It permitted the vertical radiation heat flux profiles in the atmosphere to be obtained, the real accuracy of certain theoretical procedures to be evaluated, the spectral distribution of the short-wave radiant heat flux to be obtained, and the effect of aerosols in the absorption of short-wave radiation to be estimated. Based on direct measurement data, the heat balance equation of the boundary layer was closed. Data are presented on the turbulent and radiation heat transfer in the ground and boundary layers. Author

N73-18633 Joint Publications Research Service, Arlington, Va.
INTRATROPICAL ZONE OF CONVERGENCE IN THE EASTERN PART OF THE PACIFIC OCEAN
A. I. Snitkovskiy *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 15-32 refs (For availability see N73-18631 09-20)

The characteristic features of the wind, pressure, cloud, and precipitation fields in the intratropical zone of convergence were studied. In the equatorial zone of the Northern and Southern Hemispheres in the lower 2-2.5 km, low-level jet streams can exist. The wind velocity on the axis exceeds 25 m/sec. Author

N73-18634 Joint Publications Research Service, Arlington, Va.
CHARACTERISTIC FEATURES OF THE DEVELOPMENT OF THE QUASIBIANNUAL CYCLE IN THE INDIAN OCEAN
R. F. Burlutskiy, N. N. Belskaya, and V. S. Selezneva *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 33-44 refs (For availability see N73-18631 09-20)

According to the data of ten (1967-1971) marine scientific research expeditions, the temperature and wind conditions in the stratosphere and troposphere of the equatorial latitudes of the Indian Ocean were analyzed. The characteristic features of the development of the quasi-biannual cycle in this region were discovered. Author

N73-18635 Joint Publications Research Service, Arlington, Va.
NUMBER OF SERIES OF SURGES OF TURBULENT VELOCITY PULSATIONS
V. N. Ivanov and R. L. Stratonovich *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 45-51 refs (For availability see N73-18631 09-20)

Estimates are made of the number of surge N sub h series exceeding a defined level h under the assumption that the distribution of the pulsations is Gaussian. The magnitude of the mean exceeding time for one series is defined by the dimensionality theory method. The parameters entering into the provisional mean value and the provisional correlation function are used as the defining values. Author

N73-18636 Joint Publications Research Service, Arlington, Va.
MODELS OF THE EXTREMAL ARCTIC WINTER ATMOSPHERE AT ALTITUDES OF 20-80 km
V. G. Kidiyarova and D. A. Tarasenko *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 52-60 refs (For availability see N73-18631 09-20)

Models for warm and cold conditions of the winter stratosphere of polar latitudes were studied. Estimates are presented for the asymmetry and steepness demonstrating that the winter temperature distribution in polar latitudes differs from the normal distribution law. Author

N73-18637 Joint Publications Research Service, Arlington, Va.
DISTRIBUTION OF SCATTERED SOLAR RADIATION WITH RESPECT TO SKY ZONES FOR DIFFERENT PARTS OF THE SPECTRUM IN THE ABSENCE OF CLOUDS c29
M. P. Garadzha, T. V. Yevnevich, and Ye. I. Nezval *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 61-70 refs (For availability see N73-18631 09-20)

The distribution of the scattered solar radiation in the absence of clouds by sky zones was obtained in the entire spectrum and in its visible and ultraviolet parts. The zonal radiation is presented as a function of the sun altitude. The radiation losses as a result of the closing of the horizon are estimated. Author

N73-18638 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF UTILIZING MODERN SELF-CONTAINED BUOY STATIONS FOR OCEANOGRAPHIC RESEARCH IN STRONG CURRENT AREAS c13
A. S. Gorshkov, O. N. Goncharov, I. N. Davidan, L. N. Yevdokimova, Yu. V. Sustavov, and A. N. Krylov *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 71-80 refs (For availability see N73-18631 09-20)

Calculations and simulation testing to determine the hydrodynamic and weight loads experienced by self-contained buoy stations in deep-water strong current zones of the ocean are discussed. The flow velocities were established at which it is possible to install buoy stations. Recommendations are made with respect to the development of self-contained buoy stations for strong current areas. Author

N73-18639 Joint Publications Research Service, Arlington, Va.
WIND-DRIVEN CURRENTS WITH BOTTOM SLIPPING IN SHALLOW BODIES OF WATER c13
V. S. Sinelshchikov *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 81-89 refs (For availability see N73-18631 09-20)

The linearized problem of a wind-driven current is solved under the local boundary condition of frictional slipping at the bottom. The condition is derived under certain assumptions from the nonlocal (hydraulic) Chezy friction law known from the hydraulics of flows in natural channels. The solution is compared with that obtained under the condition of adhesion. It is recommended that the proposed condition of frictional slipping be used in solving practical problems of wind-driven currents and wind surges in shallow bodies of water as reflecting the real bottom friction. Author

N73-18640 Joint Publications Research Service, Arlington, Va.
CALCULATION OF THE INTERACTION OF PENETRATABLE SHELTER BELTS AND THE GROUND AIR FLOW
I. B. Tsipris and G. V. Menzhulin *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 90-98 refs (For availability see N73-18631 09-20)

A procedure is proposed for calculating the fields of meteorological elements of the ground air flow disturbed by the presence of one or several penetratable shelter belts. The profiles of the mean horizontal wind velocity, the eddy viscosity coefficient, and the turbulence intensity inside the shelter belt and at different distances beyond it are presented. The possibility of using the developed procedure in agrosilviculture is discussed. Author

N73-18641 Joint Publications Research Service, Arlington, Va.
ACCURACY OF CALCULATING THE STATISTICAL CHARACTERISTICS OF THE GROUND LAYER OF THE WIND
R. M. Korobov *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 99-106 refs (For availability see N73-18631 09-20)

The error in calculating the temporal statistical structure of the zonal and meridional velocity components of the ground wind field was studied. The defined extrapolation of the observation error and the effect of the diurnal behavior of the wind velocity to zero were estimated; the statistical characteristics obtained for different sample intervals are compared. Author

N73-18642 Joint Publications Research Service, Arlington, Va.
PROBLEM OF POSSIBLE CORRELATION BETWEEN THE CONCENTRATION AND DENSITY OF THE FALLOUT OF LONG-LIVED ALPHA-RADIOACTIVE SUBSTANCES AND TYPES OF METEOROLOGICAL PROCESSES
B. I. Styro and N. K. Shpirkauskayte *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 107-112 refs (For availability see N73-18631 09-20)

The possibilities of appiying long-lived, alpha radioisotopes to the transfer mechanism of air masses through the tropopause were studied. These data were utilized to forecast an increase in concentration of the alpha-emitting radioactive substances at the earth's surface. Author

N73-18643*# Kanner (Leo) Associates, Redwood City, Calif.
BASE SURVEY OF CLOUD COVER BY TWO SPHERICAL MIRRORS
T. N. Bibikova Washington NASA Feb. 1973 16 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3: Fiz.-Astron. (Moscow), v. 13, no. 4, Jul. - Aug. 1972 p 387-394
(Contract NASw-2481)
(NASA-TT-F-14668) Avail: NTIS HC $3.00 CSCL 04B

Use of photos exposed through two spherical mirrors to obtain cloud base heights is explained. Space coordinates of points on the cloud cover are determined from measurements made on the photos. Measuring grids are made for plotting the cloud field. Mathematical-graphical determination of the root mean error is explained. Comparison of results with those determined with phototheodolite gives satisfactory results. Sequential surveys provide accurate velocity and direction of cloud field movement. Author

N73-18644# Secretariat General a l'Aviation Civile, Paris (France).
THE CLIMATE OF MARTINIQUE [LE CLIMAT DE LA MARTINIQUE]
M. Perrussett and S. Selbonne Oct. 1972 71 p refs In FRENCH
(MN-Mono-86) Avail: NTIS HC $5.75

Meteorological charts and tables covering rainfall, temperature, wind, precipitation intensity, and tropical storms of Martinique are presented. Transl. by E.H.W.

N73-18645# National Oceanic and Atmospheric Administration, Washington, D.C.
ESTIMATION OF AVERAGE DAILY RAINFALL FROM SATELLITE CLOUD PHOTOGRAPHS
Walton A. Follansbee Jan. 1973 44 p refs
(NOAA-TM-NESS-44) Avail: NTIS HC $4.25

A simple technique is described for estimating the average daily rainfall over sub-synoptic scale areas in the tropics and subtropics. The procedure is to determine the percentage of a given area covered by each of three rain-producing cloud types (cumulonimbus, nimbostratus, and cumulus congestus); these percentages are multiplied by empirically established coefficients to obtain the rainfall contribution to be expected from each cloud type. The method was tested for Zambia, Thailand, California, Florida and the south central United States; results were encouraging. Weighting factors to adapt the technique to the heaviest rainfall stations of India were derived. Author

N73-18646# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY NO. 12, DECEMBER 1972
2 Feb. 1973 205 p refs Transl. into ENGLISH Meteorol. Gidrol. (USSR), no. 12, Dec. 1972
(JPRS-58133) Avail: NTIS HC $12.25

Articles are presented on microclimate, agricultural meteorology, weather forecasting and climate control, hydrological forecasting, the activities and personnel of the Soviet Hydrometeorological Service, and new publications. Author

N73-18647# Joint Publications Research Service, Arlington, Va.
LASERS AND METEOROLOGY
V. M. Zakharov and O. K. Kostko 20 Mar. 1973 81 p refs Transl. into ENGLISH of the booklet "Lazery i Meteorologiya" Leningrad, Gidrometeoizdat, 1972 61 p
(JPRS-58346) Avail: NTIS HC $6.25

The basic possibilities of using lasers for studying the properties of the atmosphere are considered. Experimental data are given concerning the determination of standard meteorological parameters, and the transparency and composition of the atmosphere. Theoretical problems devoted to the effects of resonance scattering, which may originate in the propagation of laser beams in the atmosphere are discussed. The results of laser sounding of clouds and other meteorological objects and the determination of their characteristics are given. The prospects of the use of lasers in meteorology are discussed. Author

N73-18648*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
A FIELD INVESTIGATION AND NUMERICAL SIMULATION OF COASTAL FOG
E. J. Mack, W. J. Eadie, C. W. Rogers, W. C. Kocmond, and R. J. Pilie Washington NASA Feb. 1973 146 p refs
(Contract NAS8-27999)
(NASA-CR-2201; CJ-5055-M-1) Avail: NTIS HC $3.00 CSCL 04B

A field investigation of the microphysical and micrometeorological features of fogs occurring near Los Angeles and Vandenberg, California was conducted. Observations of wind speed and direction, temperature, dew point, vertical wind velocity, dew deposition, drop-size distribution, liquid water content, and haze and cloud nucleus concentration were obtained. These observations were initiated in late evening prior to fog formation and continued until the time of dissipation in both advection and radiation fogs. Data were also acquired in one valley fog and several dense haze situations. The behavior of these parameters prior to and during fog are discussed in detail. A two-dimensional numerical model was developed to investigate the formation and dissipation of advection fogs under the influence of horizontal variations in surface temperature. The model predicts the evolution of potential temperature, water vapor content, and liquid water content in a vertical plane as determined by vertical turbulent transfer and horizontal advection. Results are discussed from preliminary numerical experiments on the formation of warm-air advection fog and dissipation by natural and artificial heating from the surface. Author

N73-18649# Pennsylvania State Univ., University Park. Center of Air Environment Studies.
GUIDE TO RESEARCH IN AIR POLLUTION. PROJECTS ACTIVE IN CALENDAR YEAR 1972
Dec. 1972 389 p refs
(Contract EPA-68-02-0077)
(AP-47) Avail: NTIS HC $21.50

The active research projects are listed. The project number, name and location of the performing research organization, and project title are given along with the name of the principal investigator. F.O.S.

N73-18650# Coordinating Research Council, Inc., New York. Air Pollution Research Advisory Committee.

[CRC-ARRAC-RESEARCH PROGRESS IN ENGINEERING, ATMOSPHERIC, MEDICAL PROJECTS, AND IN-HOUSE PROGRAMS] Status Report
Jan. 1973 138 p
Avail: NTIS HC $9.00

The developments in the air pollution research program are reported. Four main categories are included: engineering research that explores the interactions between petroleum products and the automotive equipment in which the product is used; atmospheric projects aimed at explaining pollutant behavior in the atmosphere; medical projects to determine the effects of pollutants upon health; and in-house studies that utilize the laboratory facilities of industry and the Government. Brief summaries of the completed projects are presented along with a list of released reports. F.O.S.

N73-18651# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Dec. 1972 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, DECEMBRE 1972]
Dec. 1972 17 p In FRENCH and DUTCH
Avail: NTIS HC $3.00

Meteorological parameters observed at different Belgian weather stations during December 1972 are given. ESRO

N73-18652# World Meteorological Organization, Geneva (Switzerland).
THE BASIC DATA SET PROJECT Global Atmospheric Research Programme
T. Thompson Dec. 1972 111 p Prepared jointly with Intern. Council of Sci. Unions
(GARP-Publ-9) Avail: NTIS HC $7.75

The GARP recommendations for standard data sets to study the relative behavior of numerical global models are briefly described. The organization of regular and special data collection efforts to obtain global coverage are discussed in detail and the results of these efforts in terms of the amount of data actually collected are summarized. The analysis of the data for the Northern and Southern Hemispheres as well as the tropical regions is discussed and tests of data collected and stored, together with codes and formats, presented. ESRO

N73-18653# Stanford Research Inst., Menlo Park, Calif.
A MULTILAYER NUMERICAL PREDICTION MODEL FOR INVESTIGATING TROPICAL WEATHER SYSTEMS
R. M. Endlich and R. L. Mancuso Oct. 1972 43 p refs
(Contract DAHC04-71-C-0013; DA Proj. 200-61102-B-53B; SRI Proj. 1115)
(AD-752929; AROD-9432-6-EN) Avail: NTIS CSCL 04/2

A multilayer numerical weather prediction model has been developed that operates with winds, vorticity, and divergence as initial conditions. The reasons for choosing these particular variables are that a rather comprehensive dynamical model can be based on them, and they are potentially observable from meteorological satellites. For example, cloud motions shown by geosynchronous satellites are closely related to winds, and cloud types and growth rates are related to divergence and vorticity fields. The numerical model is intended primarily for subsynoptic-scale application. It is formulated so that certain empirical coefficients can be altered easily, and methods for parameterizing the effects of organized convection can be tested. The complete vorticity equation is used. The model is intended to be a research tool for use in the future with detailed data from geosynchronous satellites and other new observing systems.
Author (GRA)

N73-18654# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DIURNAL CYCLES OF HIGH ABSOLUTE HUMIDITY AT THE EARTH'S SURFACE Environmental Research Papers
Henry A. Salmela and Donald D. Grantham 5 Oct. 1972 25 p refs
(AF Proj. 8624)
(AD-753078; AFCRL-72-0587; AFCRL-ERP-416) Avail: NTIS CSCL 04/2

Previous studies of high humidities at the earth's surface are reviewed as an introduction for the purpose of formulating recommendations for absolute humidity extremes for MIL-STD-210B. Four typical diurnal cycles of dew point and temperature for periods of extremely humid conditions are described. Hourly data from Abadan, Iran, were used as the basis for the 1 percent High Absolute Humidity Extreme for design operations. This cycle includes 24 hours of dew point equal to or greater than 84F, 7 hours of which are 88F. The recommended Withstanding High Absolute Humidity Extreme for MIL-STD-210B was based on data from the tropical coastline location, Belize, British Honduras. It is comprised of 30 days in which the dew point cycles between 79F and 83F. Author (GRA)

N73-18655# Nevada Univ., Reno. Lab. of Atmospheric Physics.
DESIGN AND CONSTRUCTION OF A NEW CLOUD PARTICLE REPLICATOR FOR USE ON A PRESSURIZED AIRCRAFT Final Report, 18 May 1970 - 29 Feb. 1972
John Hallett, Richard W. Hanaway, and Peter B. Wagner 31 May 1972 44 p refs
(Contract F19628-70-C-0279)
(AD-753091; AFCRL-72-0410) Avail: NTIS CSCL 04/2

A continuous particle replicator for cloud drops and ice crystals has been constructed for use on a pressurized aircraft, the C130 of Air Force Systems Command, Hanscom Field. A design is described which has the following capabilities: produces a uniform replica over a wide range of aircraft operating conditions; gives eight speeds of film transport enabling the particle concentration on the film to be adjusted depending on the concentration in the cloud and flight speed; gives inflight viewing of the replica; and enables the film to be stopped and started in flight. Preliminary flight results show that at air speeds around 100 m/sec crystals smaller than 100 micrometers and drops smaller than 40 micrometers are replicated without serious problems, larger particles break up or shatter, although larger ice crystals, up to several mm, may still be identified.
Author (GRA)

N73-18656# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. JAPANESE AND KOREAN COASTAL MARINE AREAS. VOLUME 4: AREA 10, OKINAWA; AREA 11, SAKISHIMA ISLANDS; AREA 12, SOUTHERN EAST CHINA SEA
Dec. 1972 484 p
(AD-753216) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from Tape Data Family 11 (TDF-11) Marine Surface Observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of Coastal Marine Summaries. Author (GRA)

N73-18657# Weather Wing (3rd), Offutt AFB, Nebr.
THERMAL PARAMETERS AS A PREDICTOR OF PRECIPITATION TYPE FOR ELLSWORTH AFB, SOUTH DAKOTA
Dale G. Rogers, Limon E. Fortner, Jr., William L. Kneas, and Michael P. Cianciolo Apr. 1972 20 p refs
(AD-753418; Rept-3WW-TN-72-2) Avail: NTIS CSCL 04/2

The report presents a summary of thermal parameters as predictors of precipitation type at Ellsworth AFB, S.D. The material presented in this paper may be used in the preparation of an objective forecast when the input data is extracted from current observations and prognostic facsimile charts. The Rapid City, S.D., radiosonde data (0000Z and 1200Z) are correlated against precipitation type that occurred at Ellsworth AFB, S.D. Thermal parameter combinations used in this study are: 1000-850 mb thickness, 850-700 mb thickness, 1000-500 mb thickness; surface, 850 mb and 700 mb temperatures; 850 mb wind direction. Author (GRA)

N73-18658# Naval Postgraduate School, Monterey, Calif.
THE CLIMATOLOGY AND NATURE OF TROPICAL CYCLONES OF THE EASTERN NORTH PACIFIC OCEAN M.S. Thesis
Herbert Loye Hansen Sep. 1972 178 p refs
(AD-753584) Avail: NTIS CSCL 04/2

Meteorological satellites have revealed the need for a major revision of existing climatology of tropical cyclones in the eastern north Pacific Ocean. The years of reasonably good satellite

coverage from 1965 through 1971 provide the data base from which climatologies of frequency, duration, intensity, areas of formation and dissipation and track and speed characteristics are compiled. The climatology of recurving tracks is treated independently. The probable structure of tropical cyclones is reviewed and applied to this region. Application of these climatologies to forecasting problems is illustrated. The factors best related to formation and dissipation in this area are shown to be sea-surface temperature and vertical wind shear. The cyclones are found to be smaller and weaker than those of the western Pacific and Atlantic oceans. Author (GRA)

N73-18659# Naval Postgraduate School, Monterey, Calif.
FURTHER EXPERIMENTS WITH A HURRICANE-OCEAN INTERACTION MODEL M.S. Thesis
Nils Alexander Silliman Pearson Sep. 1972 60 p refs
(AD-753620) Avail: NTIS CSCL 04/2

Modifications were made to Corgnati's (1971) steady state, symmetrical hurricane model, which was based on a model proposed by Riehl (1963), and in which bulk aerodynamic transfer formulas were used to predict the air-sea interaction below a specified vortex. The modifications resulted in a more flexible model in which hurricane intensity was controlled by sensible and latent heat fluxes, which were in turn dependent on the ocean surface temperature. A boundary layer model based on similarity theory was then used, to specify air-sea interaction, by replacing the bulk transfer formulas with Cardone's (1969) extension of Blackadar's (1965) two-layer neutral, baroclinic boundary layer model. Author (GRA)

N73-18660# Miami Univ., Fla. Meteorological Lab.
SATELLITE AND RADAR ANALYSIS OF MESOSCALE WEATHER SYSTEMS IN THE TROPICS Final Report, 1 Jun. 1971 - 31 May 1972
Harold P. Gerrish Nov. 1972 92 p refs
(Contract DAAB07-71-C-0277; DA Proj. 1T0-61102-B-53A)
(AD-753611; UM-RASMAS-72100; ML-B-7867-2; ECOM-0277-F; FR-23) Avail: NTIS CSCL 04/2

Gridded Miami WSR-57 radar PPI data during the summer of 1968 are used to study the coverages and frequencies of radar echoes typically associated with five convective regimes in south Florida. Three sets of maps are presented showing the average coverage considering all of the data, the average coverage per echo incident and the frequency distribution of grid squares containing echoes at 0800, 1200, 1600 and 2000 EST. The maps are discussed with respect to convective echo activity, and with regard to preferred regions for the formation of anomalous propagation (A.P.). Various local effects are noted and one outstanding hot spot of convection is observed in the Lostman's River area along the southwest coast of Florida. A detailed analysis of the areal, volume, and frequency patterns of convective radar echoes on six highly disturbed dates in July 1968 reveals several interesting findings on the nature of tropical convection and the so-called atmospheric recovery period. Author (GRA)

N73-18661# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
HELICOPTER DOWNWASH APPLIED TO FOG CLEARING: A STATUS SUMMARY
Walter S. Nordquist, Jr. and David H. Dickson Oct. 1972 53 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-753357; ECOM-5465) Avail: NTIS CSCL 04/2

The report summarizes the results of a literature search and a survey of helicopter pilots concerning the use of helicopter-induced downwash to effect temporary clearings in fog. While the technique has been unsuccessfully applied in a variety of situations, the available information indicates that the criteria for determining the probability of successful application of this method is yet to be completely established. In general larger helicopters, such as the CH-54, can be successfully used for clearing fogs of 500-600 foot depth; however, smaller helicopters, such as the UN-1, do not work well for fogs of depths over 100-300 feet. Author (GRA)

N73-18662# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
MEAN HORIZONTAL WIND SPEED AND DIRECTION VARIABILITY AT HEIGHTS OF 1.5 AND 4.0 METERS ABOVE GROUND LEVEL AT WSMR, NEW MEXICO
L. J. Rider and Manuel Armendariz Ft. Monmouth, N. J. ECOM Oct. 1972 31 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-753348; ECOM-5466) Avail: NTIS CSCL 16/1

The general characteristics of wind speed and direction variability at heights of 1.5 and 4.0 meters are presented as functions of space, time, averaging time of data, mean wind speed, lag time, thermal stability (between 0.5 and 4.0 meters), and orientation of sensor line relative to mean wind direction. In addition, there is an example of mean longitudinal and lateral wind component differences and standard deviation as a function of horizontal distance separation at a height of 4.0 meters. The data show wind speed differences of less than 0.8 mps for distance separations between instruments of 150 to 175 meters and the mean wind speed less than 4 mps. Wind direction differences vary from 10 to 50 degrees. Moreover, it is shown that the standard deviation of the longitudinal wind differences has the same general characteristics as the wind speed, whereas the standard deviation of the lateral wind is similar to the wind direction. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-18663*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GUIDANCE STRATEGIES AND ANALYSIS FOR LOW THRUST NAVIGATION
R. A. Jacobson 1 Feb. 1973 27 p refs
(Contract NAS7-100)
(NASA-CR-130862; JPL-TM-33-590) Avail: NTIS HC $3.50 CSCL 17G

A low-thrust guidance algorithm suitable for operational use was formulated. A constrained linear feedback control law was obtained using a minimum terminal miss criterion and restricting control corrections to constant changes for specified time periods. Both fixed- and variable-time-of-arrival guidance were considered. The performance of the guidance law was evaluated by applying it to the approach phase of the 1980 rendezvous mission with the comet Encke. Author

N73-18664# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TACAN-DME FALSE DISTANCE LOCK-ON Final Report, Aug. 1971 - Jul. 1972
George Hartranft, Matthew Naimo, and Harold Postel Feb. 1973 63 p
(FAA Proj. 041-306-05X)
(FAA-NA-72-65; FAA-RD-72-98) Avail: NTIS HC $5.25

The results of laboratory and field tests of various Tacan ground station modifications designed to minimize the false DME problem are presented. An airborne and ground data collection package was designed to record the percentage of false replies synchronous with an aircraft interrogation. The modifications tested included a modified GRN-9 Tacan receiver, a tighter decoder tolerance modification, a jittering dead time gate, and a retriggerable long dead time gate. Although all modifications were successful in reducing the percentage of false DME, the retriggerable long dead time gate modification was the most successful in eliminating all false DME caused by multipath air-to-ground interrogations. Author

N73-18665# Joint Publications Research Service, Arlington, Va.
PROCESSING OF MEASUREMENTS IN PROBLEMS OF STELLAR ORIENTATION OF SPACECRAFT
A. V. Petrov 5 Mar. 1973 8 p refs Transl. into ENGLISH from Inzh. Zh., Mekh. Tverd. Tela (Moscow), no. 2, Mar. - Apr. 1972 p 40-43
(JPRS-58389) Avail: NTIS HC $3.00

Computational procedures for solving the problems of stellar

orientation of spacecraft are examined. Orientation errors attributed to inaccurate measurement are analyzed. E.H.W.

N73-18666# National Aviation Facilities Experimental Center, Atlantic City, N.J.
SQUARE WAVE VOR TESTS
Louis A. Dvorsky Feb. 1973 109 p
(FAA Proj. 043-309-02X)
(FAA-NA-72-60; FAA-RD-72-121) Avail: NTIS HC $7.50

Airborne and laboratory tests were performed on the 5X Square Wave VOR. Modification of both the ground facility and airborne receiver was necessary for an improvement in flyability due to suppression of reflected VOR signals. Compatibility flight tests were made using both modified and unmodified receivers on four-loop and SVOR facilities. Laboratory tests were performed on 12 different unmodified receivers to determine their response to sine and square wave modulation inputs. Author

N73-18667# Arcon Corp., Wakefield, Mass.
STUDY OF TRACKING PERFORMANCE Interim Report
Oct. 1972 48 p refs Prepared for Lincoln Lab., MIT
(Contracts F19628-70-C-0230; DOT-FA72WAI-261)
(AD-753114; R72-2W) Avail: NTIS CSCL 17/7

The report is a study of aircraft tracking techniques. The main objective of the study is to evaluate the sensitivity of tracking performance to the data environment. This environment includes velocity and acceleration measurements in addition to position data. Primary emphasis is placed on the determination of the effects of data rates and accuracies on the accuracy of the resultant track predictions. The study phase reported is concerned solely with linear tracking systems. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-18668# Atomic Energy of Canada Ltd., Chalk River (Ontario).
MATERIALS RESEARCH IN ATOMIC ENERGY OF CANADA LIMITED
1972 29 p refs
(AECL-4353) Avail: NTIS HC $3.50

Results of research are presented detailing problems of and solutions to nuclear reactor related metal alloys and fuels, and their respective behavior in reactor environments. For individual titles, see N73-18669 through N73-18674.

N73-18669 Atomic Energy of Canada Ltd., Chalk River (Ontario).
FABRICATION OF COATED PARTICLE FUEL
R. K. Rondeau and H. R. Lee *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 2-6 (For availability see N73-18668 09-22)

Nuclear fuel consisting of small fissile particles dispersed in graphite is attractive for special applications. A three-stage process for fabricating this fuel is described. Author

N73-18670 Atomic Energy of Canada Ltd., Chalk River (Ontario).
STRESS CORROSION CRACKING OF ZIRCONIUM ALLOYS c17
B. Cox *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 7-12 refs (For availability see N73-18668 09-22)

The environments causing stress-corrosion cracking of zirconium alloys are reviewed and the nature of the cracking process in each environment summarized. Author

N73-18671 Atomic Energy of Canada Ltd., Chalk River (Ontario).
STRESS-CORROSION CRACKING ZIRCONIUM ALLOY FUEL ELEMENT SHEATHS IN IODINE VAPOUR c17
J. C. Wood *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 13-15 refs (For availability see N73-18668 09-22)

Metallurgical factors influencing stress-corrosion cracking of zirconium alloys in iodine vapor are described, and a possible model for cracking of fuel element sheaths is given. Author

N73-18672 Atomic Energy of Canada Ltd., Chalk River (Ontario).
DISTRIBUTION OF ZIRCONIUM HYDRIDE IN ZIRCALOY c17
J. F. R. Ambler *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 16-18 (For availability see N73-18668 09-22)

In slowly cooled Zircaloy the amount of intergranular hydride is a linear function of the hydrogen concentration. Below approximately 423 K (150 C) all the hydride is precipitated at the grain boundaries. The orientation frequency of the intragranular hydride is a nonlinear function of the hydrogen concentration. Author

N73-18673 Atomic Energy of Canada Ltd., Chalk River (Ontario).
CRYSTAL DEFECTS STUDIED BY INTERNAL FRICTION c17
I. G. Ritchie *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 19-22 refs (For availability see N73-18668 09-22)

Internal friction measurements are made from the interaction between dislocations and point defects. Results are given for single crystals of magnesium oxide. Author

N73-18674 Atomic Energy of Canada Ltd., Chalk River (Ontario).
TECHNIQUES TO STUDY TRANSPORT PHENOMENA IN ANODIC OXIDES c06
F. Brown *In its* Mater. Res. in Atomic Energy of Can. Ltd. 1972 p 23-26 refs (For availability see N73-18668 09-22)

Techniques were developed to study whether anodic oxides grow by migration of oxygen, metal, or both, and also to study the movement of foreign atoms in anodic oxides. These techniques could find applications in thermal oxidation, corrosion, and investigations of their films in general. Author

N73-18675*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TESTING OF URANIUM NITRIDE FUEL IN T-111 CLADDING AT 1200 K CLADDING TEMPERATURE
Robert G. Rohal, Thomas N. Tambling, and Roger L. Smith Washington Mar. 1973 26 p refs
(NASA-TM-X-2732; E-7192) Avail: NTIS HC $3.00 CSCL 18J

Two groups of six fuel pins each were assembled, encapsulated, and irradiated in the Plum Brook Reactor. The fuel pins employed uranium mononitride (UN) in a tantalum alloy clad. The first group of fuel pins was irradiated for 1500 hours to a maximum burnup of 0.7-atom-percent uranium. The second group of fuel pins was irradiated for about 3000 hours to a maximum burnup of 1.0-atom-percent uranium. The average clad surface temperature during irradiation of both groups of fuel pins was approximately 1200 K. The postirradiation examination revealed the following: no clad failures or fuel swelling occurred; less than 1 percent of the fission gases escaped from the fuel; and the clad of the first group of fuel pins experienced clad embrittlement whereas the second group, which had modified assembly and fabrication procedures to minimize contamination, had a ductile clad after irradiation. Author

N73-18676*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY NEUTRONIC ANALYSIS OF A CAVITY TEST REACTOR
Charles L. Whitmarsh, Jr. Washington Mar. 1973 32 p refs
(NASA-TM-X-2743; E-7193) Avail: NTIS HC $3.00 CSCL 18I

A reference configuration was calculated for a cavity test reactor to be used for testing the gascore nuclear rocket concept. A thermal flux of 4.1 x 10 to the 14th power neutrons per square centimeter per second in the cavity was provided by a driver fuel loading of 6.4 kg of enriched uranium in MTR fuel elements. The reactor was moderated and cooled by heavy water and reflected with 25.4 cm of beryllium. Power generation of 41.3 MW in the driver fuel is rejected to a heat sink. Design effort was directed toward minimization of driver power while maintaining 2.7 MW in the cavity during a test run. Ancillary data on material reactivity worths, reactivity coefficients, flux spectra, and power distributions are reported. Author

N73-18677*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RESULTS OF URANIUM DIOXIDE-TUNGSTEN IRRADIATION TEST AND POST-TEST EXAMINATION
John F. Collins, Claude E. DeBogdan, and Dominic C. Dilanni Washington Mar. 1973 77 p refs
(NASA-TM-X-2709; E-7083) Avail: NTIS HC $3.00 CSCL 18H

A uranium dioxide (UO2) fueled capsule was fabricated and irradiated in the NASA Plum Brook Reactor Facility. The capsule consisted of two bulk UO2 specimens clad with chemically vapor deposited tungsten (CVD W) 0.762 and 0.1016 cm (0.030-and 0.040-in.) thick, respectively. The second specimen with 0.1016- cm (0.040-in.) thick cladding was irradiated at temperature for 2607 hours, corresponding to an average burnup of 1.516 x 10 to the 20th power fissions/cu cm. Postirradiation examination showed distortion in the bottom end cap, failure of the weld joint, and fracture of the central vent tube. Diametral growth was 1.3 percent. No evidence of gross interaction between CVD tungsten or arc-cast tungsten cladding and the UO2 fuel was observed. Some of the fission gases passed from the fuel cavity to the gas surrounding the fuel specimen via the vent tube and possibly the end-cap weld failure. Whether the UO2 loss rates through the vent tube were within acceptable limits could not be determined in view of the end-cap weld failure.
Author

N73-18678*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF TEMPERATURE-DEPENDENT NEUTRON TRANSMISSION AND SELF-INDICATION MEASUREMENTS ON TANTALUM AT 2-keV NEUTRON ENERGY
Thor T. Semler Washington Mar. 1973 47 p refs
(NASA-TN-D-7214; E-7282) Avail: NTIS HC $3.00 CSCL 18H

The method of pseudo-resonance cross sections is used to analyze published temperature-dependent neutron transmission and self-indication measurements on tantalum in the unresolved region. In the energy region analyzed, 1825.0 to 2017.0 eV, a direct application of the pseudo-resonance approach using a customary average strength function will not provide effective cross sections which fit the measured cross section behavior. Rather a local value of the strength function is required, and a set of resonances which model the measured behavior of the effective cross sections is derived. This derived set of resonance parameters adequately represents the observed resonance behavior in this local energy region. Similar analyses for the measurements in other unresolved energy regions are necessary to obtain local resonance parameters for improved reactor calculations. This study suggests that Doppler coefficients calculated by sampling from grand average statistical distributions over the entire unresolved resonance region can be in error, since significant local variations in the statistical distributions are not taken into consideration.
Author

N73-18679*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF BACKLASH AND DEAD BAND ON TEMPERATURE CONTROL OF THE PRIMARY LOOP OF A CONCEPTUAL NUCLEAR BRAYTON SPACE POWERPLANT
Edward J. Petrick Washington Mar. 1973 23 p refs
(NASA-TM-X-2754; E-7276) Avail: NTIS HC $3.00 CSCL 18I

An analytical study was made of the stability of a closed-loop liquid-lithium temperature control of the primary loop of a conceptual nuclear Brayton space powerplant. The operating point was varied from 20 to 120 percent of design. A describing-function technique was used to evaluate the effects of temperature dead band and control coupling backlash. From the system investigation, it was predicted that a limit cycle will not exist with a temperature dead band, but a limit cycle will not exist when backlash is present. The results compare favorably with a digital computer simulation.
Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-18680*# Radio Corp. of America, Princeton, N.J.
OPTICAL MEMORY DEVELOPMENT. VOLUME 1: PROTOTYPE MEMORY SYSTEM Interim Report, 12 Mar. 1971 - 17 Oct. 1972
L. S. Cosentino, R. S. Mezrich, E. M. Nagle, W. C. Stewart, and F. S. Wendt Nov. 1972 71 p refs
(Contract NAS8-26808)
(NASA-CR-124084; PRRL-72-CR-53-Vol-1) Avail: NTIS HC $5.75 CSCL 20A

The design, development, and implementation of a prototype, partially populated, million bit read-write holographic memory system using state-of-the-art components are described. The system employs an argon ion laser, acoustooptic beam deflectors, a holographic beam splitter (hololens), a nematic liquid crystal page composer, a photoconductor-thermoplastic erasable storage medium, a silicon P-I-N photodiode array, with lenses and electronics of both conventional and custom design. Operation of the prototype memory system was successfully demonstrated. Careful attention is given to the analysis from which the design criteria were developed. Specifications for the major components are listed, along with the details of their construction and performance. The primary conclusion resulting from this program is that the basic principles of read-write holographic memory system are well understood and are reducible to practice.
Author

N73-18681*# Radio Corp. of America, Princeton, N.J.
OPTICAL MEMORY DEVELOPMENT. VOLUME 2: GAIN-ASSISTED HOLOGRAPHIC STORAGE MEDIA Interim Report, 12 Mar. 1971 - 17 Oct. 1972
R. A. Gange and R. S. Mezrich Nov. 1972 81 p refs
(Contract NAS8-26808)
(NASA-CR-124083; PRRL-72-CR-54-Vol-2) Avail: NTIS HC $6.25 CSCL 20A

Thin deformable films were investigated for use as the storage medium in a holographic optical memory. The research was directed toward solving the problems of material fatigue, selective heat addressing, electrical charging of the film surface and charge patterning by light. A number of solutions to these problems were found but the main conclusion to be drawn from the work is that deformable media which employ heat in the recording process are not satisfactory for use in a high-speed random-access read/write holographic memory. They are, however, a viable approach in applications where either high speed or random-access is not required.
Author

N73-18682*# Radio Corp. of America, Princeton, N.J.
OPTICAL MEMORY DEVELOPMENT. VOLUME 3: THE MEMBRANE LIGHT VALVE PAGE COMPOSER Interim Report, 12 Mar. 1971 - 17 Oct. 1972
L. S. Cosentino, E. M. Nagle, and W. C. Stewart Nov. 1972 63 p refs
(Contract NAS8-26808)
(NASA-CR-124085; PRRL-72-CR-55) Avail: NTIS HC $5.25 CSCL 20F

The feasibility of producing a page composer for optical memory systems using thin, deformable, membrane-mirror elements as light valves was investigated. The electromechanical and optical performances of such elements were determined both analytically and experimentally. It was found that fast switching (approximately 10 microseconds), high-contrast (10 or greater), fatigue-free operation over missions of cycles, and efficient utilization of input light could be obtained with membrane light valves. Several arrays of 64 elements were made on substrates with feedthroughs, allowing access to individual elements from the backside of the substrate. Single light valves on such arrays were successfully operated with the transistors designed and produced for selection and storage at each bit location. This simulated the operation of a prototype page composer with

semiconductor chips beam-lead bonded to the back of the substrate. Author

N73-18683*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
DESIGN AND FABRICATION OF ENGINEERING MODEL FIBER-OPTICS DETECTOR Final Report
A. McSweeney 31 Dec. 1972 25 p refs
(Contract NAS8-28215; Proj. A-1392)
(NASA-CR-124089) Avail: NTIS HC $3.25 CSCL 20F

The design and fabrication of an annular ring detector consisting of optical fibers terminated with photodetectors is described. The maximum width of each concentric ring has to be small enough to permit the resolution of a Ronchi ruling transform with a dot spacing of 150 microns. A minimum of 100 concentric rings covering a circular area of 2.54 cm diameter also is necessary. A fiber-optic array consisting of approximately 89,000 fibers of 76 microns diameter was fabricated to meet the above requirements. The fibers within a circular area of 2.5 cm diameter were sorted into 168 adjacent rings concentric with the center fiber. The response characteristics of several photodetectors were measured, and the data used to compare their linearity of response and dynamic range. Also, coupling loss measurements were made for three different methods of terminating the optical fibers with a photodetector. Author

N73-18684*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE CONFERENCE ON PARALLEL IMAGE PROCESSING FOR EARTH OBSERVATION SYSTEMS
Mar. 1972 192 p refs Conf. held at Greenbelt, Md., 2-3 Mar. 1972
(NASA-TM-X-66175; X-711-72-308) Avail: NTIS HC $11.75 CSCL 20F

Conference papers are reported on optical and digital image processing techniques, problems of earth observation, and real time devices to convert from noncoherent to the coherent realm. For individual titles, see N73-18685 through N73-18696.

N73-18685*+ Radiation, Inc., Ann Arbor, Mich.
REVIEW OF COHERENT OPTICAL DATA PROCESSING
A. VanderLugt *In* NASA. Goddard Space Flight Center Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 9-19 (For availability see N73-18684 09-23)
Avail: NTIS CSCL 20F

The fundamental features of coherent optical data processing systems are reviewed for potential application to image processing. The application of optical spatial filtering to image mapping and cloud motion is discussed. F.O.S.

N73-18686* Sperry Rand Research Center, Sudbury, Mass.
OPTICAL PROCESSING IN INCOHERENT LIGHT
W. T. Maloney *In* NASA. Goddard Space Flight Center Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 21-39 refs (For availability see N73-18684 09-23)
CSCL 20F

The basic principles of incoherent image processing are presented and the advantages and disadvantages of this approach are discussed. Author

N73-18687* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL IMAGE PROCESSING FOR PHOTO-RECONNAISSANCE APPLICATIONS
Fred C. Billingsley *In* NASA. Goddard Space Flight Center Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 41-57 refs (For availability see N73-18684 09-23)
(Contract NAS7-100)
CSCL 20F

Digital image-processing techniques developed for processing pictures from NASA space vehicles are analyzed in terms of enhancement, quantitative restoration, and information extraction. Digital filtering, and the action of a high frequency filter in the real and Fourier domain are discussed along with color and brightness. F.O.S.

N73-18688* Honeywell, Inc., Hopkins, Minn. Research Center.
REVIEW OF OPTICAL MEMORY TECHNOLOGIES
D. Chen *In* NASA. Goddard Space Flight Center Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 59-60 (For availability see N73-18684 09-23)
CSCL 20F

Optical technologies for meeting the demands of large capacity fast access time memory are discussed in terms of optical phenomena and laser applications. The magneto-optic and electro-optic approaches are considered to be the most promising memory approaches. F.O.S.

N73-18689* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA PROCESSING REQUIREMENTS FOR THE EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS) c13
John Y. Sos *In its* Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 61-70 (For availability see N73-18684 09-23)
CSCL 05B

Some of the data handling considerations that led to the formulation of the data processing requirements for the ERTS system are discussed. The significant parameters that influence these requirements are: (1) payload characteristics, (2) spacecraft characteristics such as orbit, attitude and attitude rates, (3) payload coverage, and (4) product types and quantities. Items 3 and 4 have had the most significant influence on the generation of the requirements. Author

N73-18690* General Electric Co., Philadelphia, Pa.
SPACE VEHICLE-BORNE APPLICATION OF OPTICAL DATA PROCESSING
Joseph D. Welch *In* NASA. Goddard Space Flight Center Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 75-91 (For availability see N73-18684 09-23)
CSCL 20F

A model is considered for vehicle-borne parallel optical data processing which might be used as a key part of an advanced earth resources satellite mission. Some typical applications and the operation of the on-board processor are discussed. F.O.S.

N73-18691* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GODDARD SPACE FLIGHT CENTER PROGRAM TO DEVELOP PARALLEL IMAGE PROCESSING SYSTEMS
David H. Schaefer *In its* Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 95-101 (For availability see N73-18684 09-23)
CSCL 20F

Parallel image processing which is defined as image processing where all points of an image are operated upon simultaneously is discussed. Coherent optical, noncoherent optical, and electronic methods are considered parallel image processing techniques. F.O.S.

N73-18692* Hughes Research Labs., Malibu, Calif.
THE LIQUID CRYSTAL LIGHT VALVE, AN OPTICAL-TO-OPTICAL INTERFACE DEVICE
A. D. Jacobson, T. D. Beard, W. P. Bleha, J. D. Margerum, and S. Y. Wong *In* NASA. Goddard Space Flight Center Proc. of the Conf. of Parallel Image Process. for Earth Observation Systems Mar. 1972 p 103-113 refs (For availability see N73-18684 09-23)
CSCL 20F

A photoactivated liquid crystal light valve is described as an optical-to-optical interface device (OTTO) which is designed to transfer an optical image from a noncoherent light beam to a spatially coherent beam of light, in real time. Schematics of OTTO in use, the liquid cyrstal cell, and the liquid crystal structure are presented. Sensitivity characteristics and the principles of operation are discussed. F.O.S.

N73-18693* Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
THE SYNTHESIS OF COMPLEX SPATIAL FILTERS FOR COHERENT OPTICAL DATA PROCESSING
Sing H. Lee *In* NASA. Goddard Space Flight Center Proc. of

the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 115-139 refs (For availability see N73-18684 09-23)
CSCL 20F

Recent research on filter synthesis is summarized, and the implications in optical computation, image processing, image restoration, and image detection are examined. F.O.S.

N73-18694* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN CONCEPTS FOR AN ON-BOARD COHERENT OPTICAL IMAGE PROCESSOR
Akram S. Husain-Abidi *In its* Proc. of the Conf. on Parallel Image Process for Earth Observation Systems Mar. 1972 p 141-158 refs (For availability see N73-18684 09-23)
CSCL 20F

On-board spacecraft image data processing systems for transmitting processed data rather than raw data are discussed. A brief history of the development of the optical data processing techniques is presented along with the conceptual design of a coherent optical system with a noncoherent image input. F.O.S.

N73-18695* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PARALLEL IMAGE LOGICAL OPERATIONS USING CROSS CORRELATION
James P. Strong, III *In its* Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 159-170 refs (For availability see N73-18684 09-23)
CSCL 20F

Methods are presented for counting areas in an image in a parallel manner using noncoherent optical techniques. The techniques presented include the Levialdi algorithm for counting, optical techniques for binary operations, and cross-correlation. F.O.S.

N73-18696* Perkin-Elmer Corp., Norwalk, Conn.
DIGITAL HOLOGRAPHIC LOGIC
K. Preston, Jr. *In* NASA. Goddard Space Flight Center Proc. of the Conf. on Parallel Image Process. for Earth Observation Systems Mar. 1972 p 171-188 refs (For availability see N73-18684 09-23)
CSCL 20E

The characteristics of the holographic logic computer are discussed. The holographic operation is reviewed from the Fourier transform viewpoint, and the formation of holograms for use in performing digital logic are described. The operation of the computer with an experiment in which the binary identity function is calculated is discussed along with devices for achieving real-time performance. An application in pattern recognition using neighborhood logic is presented. Author

N73-18697*# Kanner (Leo) Associates, Redwood City, Calif.
IRRADIATION OF 'SOFT' PHOTONS IN AN INTENSE ELECTROMAGNETIC WAVE FIELD
Yu. V. Grats and Yu. G. Pavlenko Washington NASA Feb. 1973 7 p refs Transl. into ENGLISH from Vestn. Mosk. Uni. v., Ser. 3: Fiz.-Astron. (Moscow), v. 13, no. 4, Jul.-Aug. 1972 p 477-478
(Contract NASw-2481)
(NASA-TT-F-14686) Avail: NTIS HC $3.00 CSCL 20J

A method of simplifying study of second order processes in interactions of particles with electromagnetic fields in the low frequency range, by generalizing known approximation methods, is discussed. Study of the amplitude of a process not involving soft photon emission, in parallel with the process involving emission of one soft photon, leads to derivation of relations for determining the amplitude of the photon emission process. Author

N73-18698# Lockheed Missiles and Space Co., Palo Alto, Calif.
STATISTICAL THEORY OF LIGHT PROPAGATION IN A TURBULENT MEDIUM (SURVEY)
V. I. Kliatskin and V. I. Tatarskii [1972] 23 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Radiofiz. (USSR), v. 15, no. 10, 1972 p 1433-1455
Avail: NTIS HC $3.25; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Light wave propagation in a turbulent medium is analyzed by an approximative diffusion random model. The refractive index by a delta function in the longitudinal direction is used to obtain closed integral equations for all moments of the wave field. An assumption on the Gaussian distribution of fluctuation probabilities and successive approximations for the solution of the stochastic wave propagation equation are used to compute the mutual coherence function in the turbulent medium. G.G.

N73-18699# Lockheed Missiles and Space Co., Palo Alto, Calif.
SPECTRAL DENSITY CHARACTERISTICS OF RANDOM PROCESSES (PARTICULAR CASES)
V. I. Vinokurov and R. A. Vakker [1972] 4 p Transl. into ENGLISH from the book "Voprosy Obrabotki Slozhnykh Signalov v Korreliatsionnykh Sistemakh" Moscow, Sovetskoe Radio, 1972 p 109-115
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Loss coefficients are expressed in functions that depend on the shapes of the energy spectra in random processes. Functions for random processes during the passage of white noise through an ideal filter, a single oscillatory loop, and a band filter are developed. G.G.

N73-18700# Syracuse Univ., N.Y. Dept. of Physics.
EQUIVALENCE OF NULL PLANE AND CONVENTIONAL QUANTUM ELECTRODYNAMICS
James H. TenEyck and F. Rohrlich Jan. 1973 22 p refs Sponsored by NSF
Avail: NTIS HC $3.25

The physical equivalence is proved of null plane quantum electrodynamics in the null plane gage to that of the conventional one in the Coulomb gage. This is done formally within the frame work of Feynman-Dyson-Schwinger theory. The equivalence of the dynamic equations and of the commutation relations in the two formulations is proved in the Heisenberg picture. In the interaction picture this requires that the free fields be defined over a test function space corresponding physically to the absence of photons propagating along one space axis (which can be chosen arbitrarily). The proof has the virtue of being based on a positive definite Hilbert space. This is possible because the null plane gage, as well as the Coulomb gage, does not require supplementary conditions on state vectors nor fields with wrong commutation relations. A great deal of complexity of formalism is thereby avoided. Author

N73-18701# Syracuse Univ., N.Y. Dept. of Physics.
MODEL FOR UNIFIED STRONG AND ELECTROMAGNETIC INTERACTIONS
A. Aurilia and F. Rohrlich [1972] 14 p refs Sponsored by NSF
Avail: NTIS HC $3.00

Following the ideas expressed by Nambu and Jona-Lasinio and by Bjorken, the question arises whether theories of this type can in principle combine strong and electromagnetic interactions. A model field theory is constructed which is based on a gauge and chiral invariant lagrangian consisting of a massless fermion in quartic self-interaction of scalar, pseudoscalar, and vector type. Spontaneous symmetry breaking results in a massive fermion and use of the chain approximation leads to the identification of the resulting collective excitations with a pion (in zero mass approximation), and a photon. Similarities and differences between this work and previous papers, and with currently popular unified field theories are outlined, together with the possibilities and the limitations of the model. Author

N73-18702*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECTS OF FLOW TURBULENCE AND NOISE ON AERODYNAMIC PHENOMENA AND MEASURED QUANTITIES
R. Michel Washington NASA Mar. 1973 12 p Transl. into ENGLISH of "Effets de la Turbulence et du Bruit sur les Phenomes Aerodynamiques et les Resultats d'essai en Soufflerie", Paper presented at Von Karman Inst., Rhode Saint-Genese, Belgium, 31 Jan. 1973
(Contract NASw-2481)
(NASA-TT-F-14833) Avail: NTIS HC $3.00 CSCL 20A

The effects of flow turbulence and noise on transition and

boundary layer development, as well as the results of tests in wind tunnels, are discussed. The effects of flow turbulence and noise on transition, the effects on turbulent boundary layer development, and on the results of tests in wind tunnels are duly illustrated in the accompanying figures. Author

N73-18703# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Munich (West Germany).
OIL DAMPED RESONANCE ABSORBER FOR UNDERWATER SOUND [OELGEDAEMPFTER RESONANZABSORBER FUER WASSERSCHALL]
H.-W. Leuschner Bonn Bundeswehramt 1972 55 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-2) Avail: NTIS HC $4.75; Bundeswehramt 25 DM

A thin-layer absorber for underwater sound, covering a wide range of frequency, temperature, and pressure, and constructed similarly to the cavity absorber used in room acoustics is described. The sound produces an alternating flow of a silicon oil through small holes in its direction of incidence. This resonance absorber is tuned by plugs of sponge rubber behind the holes. The low temperature dependence of this type of absorber is due mainly to the silicon oil which is used as a viscous fluid. The viscosity of the oil, and the diameter and length of the holes, determine ,the flow resistance, which is independent of static pressure. Under pressure the absorbing properties are determined only by the pressure dependence of the sponge-rubber plug, which acts like a spring. Thus only the resonance frequency of the absorber, which may be treated as a parallel resonance circuit, depends on pressure. Over the wide frequency band of this one-circuit resonance absorber, its absorption remains almost unchanged under overpressure of up to more than 5 atmospheres. The temperature range of operation is above 20 C. Author (ESRO)

N73-18704*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
A SYSTEMATIC STUDY OF SUPERSONIC JET NOISE Final Report
Jean F. Louis Dec. 1971 74 p refs
(Grant NGL-22-009-383; Contract DOT-TSC-142)
(NASA-CR-130964; DOT-TSC-142-1; PB-211954) Avail: NTIS HC $5.75 CSCL 21E

Acoustic fields associated with two different nozzle configurations, a rectangular and a circular, are studied. Both nozzles were designed with the same exit Mach number and have an identical momentum and energy flux. So far tests have been made in the range of 1000-5000 degrees R, for different levels of expansion and an exit Mach number of 2.7. In comparing the two nozzles, it is found that the rectangular nozzle is indeed quieter than the circular nozzle. Author (GRA)

N73-18705# Office of Naval Research, London (England).
THE 4TH INTERNATIONAL CRYOGENIC ENGINEERING CONFERENCE
Robert A. Hein and E. A. Edelsack 20 Oct. 1972 45 p refs Conf. held at Eindhiven, Netherlands, 24-26 May 1972
(AD-753456; ONRL-C-14-72) Avail: NTIS CSCL 20/12

Contents: Uses of low temperatures; Materials; ac losses in superconductors; Superconducting; Magnets; Energy storage and transmission; Ultra low temperatures; Superconducting levitation. GRA

N73-18706# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A METHOD TO COMPARE THE POTENTIAL OF A FLOWING LIQUID HYDROCARBON TO GENERATE STATIC ELECTRICITY M.S. Thesis
Valentine L. Denninger Jun. 1972 81 p refs
(AD-753386; GA/ME/72-4) Avail: NTIS CSCL 20/3

The study examines static charge generation in hydrocarbon fuels during flow through pipes. Particular emphasis is placed on the effect of linear velocity, pipe diameter and length, and the liquid solid interface. A parameter was developed which may be of use to system designers as a basis for comparing static electric charge generating characteristics of various fuel-container material combinations. Laboratory scale apparatus for the measurement of conductivity and charge density in the flowing fluid was designed, constructed and instrumented. A by product of this work was the development of a fully guarded parallel plate conductivity cell which indicates some improvement over other designs. GRA

N73-18707# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL INVESTIGATION OF THE INFLUENCE OF THE PARAMETERS OF A DYNAMIC SYSTEM ON THE SPECTRUM OF NATURAL FREQUENCIES
V. K. Grinkevich and R. B. Stantnikov 27 Oct. 1972 19 p refs Transl. into ENGLISH from Mashinovedenie (Moscow), no. 4, 1970 p 3-9
(AD-752695; FTD-MT-24-288-72) Avail: NTIS CSCL 20/11

The article analyzes the application of statistical methods for determination of the optimal parameters corresponding to selected frequency criteria. Determination of these parameters is performed by the Monte Carlo method; their adjustment by the Gauss - Seidel method and random search. The method of solution suggested, based on the method of statistical testing using regular methods of search for the extreme, is rather universal. It can be used both for linear and for nonlinear systems with both concentrated and distributed masses. Author (GRA)

N73-18708# Naval Undersea Center, San Diego, Calif.
SCATTERING FROM AN ELASTIC SPHERICAL SHELL Research and Development Report, Feb. - Oct. 1971
William F. Fender Oct. 1972 39 p refs
(SF11121304)
(AD-752760; NUC-TP-313) Avail: NTIS CSCL 20/1

A mathematical model was developed to predict the scattering of a plane acoustic wave from an elastic spherical shell with different fluid media inside and out. The model was developed from the more convenient standpoint of elastic theory rather than from the acoustic point of view. Resulting equations were solved in terms of known functions. Matrix methods were used throughout. A numerical method is presented that takes advantage of some peculiarities of the resulting matrix and is appropriate to computer implementation. Some results of a computer program for the spherical shell are given. A few limiting cases of the exact solutions are compared with previously reported results. Author (GRA)

N73-18709# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELECTRIC FIELDS GENERATED BY SYMMETRIC INWARD EMISSION OF ELECTRONS FROM CYLINDRICAL AND SPHERICAL SHELLS M.S. Thesis
Marcus R. Skeem Dec. 1972 84 p refs
(AD-753014; GEP/PH/73-21) Avail: NTIS CSCL 20/3

Simple analytic models incorporating assumptions based on physical arguments are developed to calculate the electrostatic fields produced inside cylinders and spheres by internal electromagnetic pulses. Integral equations for the potentials in the cavities are derived from Poisson's equation and energy conservation and are solved self-consistently for a representative energy spectrum. The numerical solutions are checked against analytic solutions in the limit of small space-charge effects and numerical results for the electrostatic potential, electric field, and charge density are presented. GRA

N73-18710# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEGAGAUSS PHYSICS
Heimo G. Latal 27 Oct. 1972 32 p refs Transl. into ENGLISH from Acta Phys. Austriaca (Vienna), no. 34, 1971 p 65-82
(AD-753042; FTD-HT-23-1388-72) Avail: NTIS CSCL 20/3

The following topics are discussed: Production of megagauss fields; Application of megagauss fields; Quantum electrodynamics in high magnetic fields. GRA

N73-18711# Airborne Instruments Lab., Deer Park, N.Y.
A 10-MICROMETERS DETECTOR Semiannual Report
W. Chiou, M. Aita, and F. Pace Nov. 1972 71 p refs
(Contract N00014-70-C-0161; ARPA Order 1806)
(AD-753275) Avail: NTIS CSCL 20/6

The purpose of the program is to continue the research on 10.6 micrometer image upconversion detectors and to determine

the feasibility of developing a 10.6 micrometer range gated upconversion imaging laser radar receiver with 150 by 150 resolution elements. An experimental model image upconverter capable of real time direct viewing has been assembled. Imaging characteristics such as resolution, field of view, and the upconversion efficiency of the experimental model were measured by arranging the model in the Fourier space and the image space configurations. Analysis describing the optical transfer function of the Fourier space configuration and the line spread functions of non-Fourier space configuration are presented. The crystal birefringency is included in the analysis. Calculation of resolving power and some consideration on the object optics are also included. Measurements of conversion efficiency and realistic estimates of practically achievable efficiency are presented and realistic values for the SHG d coefficients of proustite are considered. GRA

N73-18712# Ballistic Research Labs., Aberdeen Proving Ground, Md.
INTENSITY INTERFEROMETRY IN THE SPATIAL DOMAIN
Paul H. Dietz and F. Paul Carlson Oct. 1972 31 p refs Presented at the meeting of the Opt Soc. of Am., San Francisco, 17-20 Oct. 1972
(AD-752902; BRL-1616) Avail: NTIS CSCL 20/6

Intensity interferometry, as developed by Hanbury Brown and Twiss for stellar observation, has shown relative insensitivity to atmospheric scintillation. However, with classical sources, the limitations placed on this technique by quantum noise and detector efficiency are somewhat severe. This situation is vastly improved when laser illumination is employed. Generalizing a methodology of Marchand and Wolf, the far-zone behavior of the mutual intensity function is derived for an intermediate time average. This result is used to reconstruct the irradiance distribution of a spatially-incoherent source. The far-field intensity distribution is recorded spatially for one time-resolution unit of the detector. The resulting spatial signal is cross correlated with itself and related to the intensity distribution over the source. Thus without averaging in the time domain, a spatial Fourier transform relation is derived between the far-field intensity correlation and the source irradiance, similar to the results of Hanbury Brown and Twiss. Author (GRA)

N73-18713# Army Electronics Command, Fort Monmouth, N.J.
OPTICAL MATERIALS INVESTIGATION FOR ULTRAVIOLET DOWN-CONVERTERS
J. C. Gwaltieri, T. F. Ewanizky, and D. Berndt Oct. 1972 22 p refs
(DA Proj. 1S0-62102-A-042)
(AD-753578; ECOM-4037) Avail: NTIS CSCL 20/6

The report covers the first four months effort on the development of an ultraviolet down-converter to selected visible spectral regions. It consists mainly of knowledge drawn from literature searches, discussions with personnel in-house and in private industry, recent solid state laser spectroscopic research experience, and some preliminary spectroscopic data. Possible solid state down-converter materials, their transmission regions and methods of production for crystalline materials are discussed. The spectroscopic properties of rare earth ions which are especially suited for radiation conversion via visible fluorescence are reviewed. Finally, the performance properties of some of these materials are summarized and recommendations for further research are given. Author (GRA)

N73-18714# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE ELECTROMAGNETIC FIELDS DUE TO RADIAL CURRENTS NEAR A PERFECTLY CONDUCTING SPHERE M.S. Thesis
Robert L. Gardner Mar. 1973 84 p refs
(AD-753664; GEP/PH/73-923) Avail: NTIS CSCL 20/3

The dyadic Green's function technique is applied to the problem of determining the electromagnetic fields due to radial electron emission near a perfectly conducting sphere. The application of the technique results in formal solutions for the surface current on the sphere and the curlless field within the electron cloud which causes the currents. Two electron velocity functions are used. They are the constant velocity case and the case in which the velocity falls off in a central potential. The analysis of the problem is simplified by ignoring electron-electron interactions, electromagnetic field-electron interactions, and the potential due to ions left on the surface of the sphere. Both time domain and Laplace transform domain solutions are obtained. The singularity expansion method is used to determine the inverse transforms of the Laplace domain field expressions. The final field expressions are in formal series form. The series are not summed. Author (GRA)

N73-18715# Instrumentation Development Directorate, White Sands Missile Range, N.Mex.
EVALUATION OF AN IMAGE INTENSIFIER SYSTEM FOR USE ON TRACKING TELESCOPES Final Report
Charles R. Hayslett Nov. 1972 37 p
(DA Proj. 1U2-65302-D-240)
(AD-753342; STEWS-ID-I-72-7) Avail: NTIS CSCL 09/1

An image intensifier system has been designed and fabricated to mount on a long focal length telescope that is to be used for daytime missile tracking. The image intensifier system was evaluated both in the laboratory and on the telescope at a field site. The evaluation showed the image intensifier system provided adequate light gain to allow for faster sampling rates, longer focal lengths, and higher f/number telescopes. The results of degradation to image quality consequential to providing this light gain are discussed. The field evaluation showed that the system has the capability to record data on missiles from launch to impact, 25 miles up range. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-18716*# Nevada Univ., Reno. Dept. of Physics.
CALCULATION OF PHOTOIONIZATION CROSS SECTION NEAR AUTO-IONIZING LINES AND MAGNESIUM PHOTO-IONIZATION CROSS SECTION NEAR THRESHOLD
E. Neal Moore and P. L. Altick 5 Dec. 1972 3 p refs
(Grant NGR-29-001-008)
(NASA-CR-130884) Avail: NTIS HC $3.00 CSCL 20H

The research performed is briefly reviewed. A simple method was developed for the calculation of continuum states of atoms when autoionization is present. The method was employed to give the first theoretical cross section for beryllium and magnesium; the results indicate that the values used previously at threshold were sometimes seriously in error. These threshold values have potential applications in astrophysical abundance estimates. Author

N73-18717# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.
GENERATION OF INTENSE MOLECULAR BEAMS OF SUBORBITAL ENERGIES FOR USE IN SCATTERING EXPERIMENTS
U. Bossel 7 Mar. 1973 50 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-52) Avail: NTIS HC $4.50; DFVLR Proz: 16,50 DM

Different methods of producing neutral molecular beams of energies ranging between 1 and 20 eV are examined with regards to their usefulness in experiments of technical importance. Four known aerospace projects serve to define the free stream conditions which must be carefully simulated in the laboratory if relevant answers are desired in scattering experiments. Author

N73-18718*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLARIZATION PHENOMENA IN MULTIPHOTON IONIZATION OF ATOMS
V. L. Jacobs Feb. 1973 27 p refs Submitted for publication
(NASA-TM-X-66179; X-641-73-21) Avail: NTIS HC $3.50

CSCL 20H

The theory of multiphoton ionization for an atomic system of arbitrary complexity is developed using a density matrix formalism. An expression is obtained which determines the differential N-photon ionization cross section as a function of the polarization states of the target atom and the incident radiation. The parameters which characterize the photoelectron angular distribution are related to the general reduced matrix elements for the N-photon transition. Two-photon ionization of unpolarized atoms is treated as an illustration of the use of the theory. The dependence of the multiphoton ionization cross section on the polarization state of the incident radiation, which has been observed in two- and three-photon ionization of Cs, is accounted for by the theory. Finally, the photoelectron spin polarization produced by the multiphoton ionization of unpolarized atoms, like the analogous polarization resulting from single-photon ionization, is found to depend on the circular polarization of the incident radiation.
Author

N73-18719# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
IMPROVEMENTS IN THE STUDY OF TEMPORAL INFORMATION SAMPLING IN NUCLEAR SPECTROMETRY Ph.D. Thesis - Paris Univ., Orsay
Jean Deroche Jul. 1972 126 p refs In FRENCH
(CEA-R-4355) Avail: AEC Depository Libraries

The sampling of temporal information was studied by observing the signals produced at the output of planar lithium compensated germanium n-i-n detectors in gamma ray spectrometry. Fluctuations in the form of the signals were overcome by making the detection threshold as low as possible. The noise problem which subsequently arose was resolved by the use of time discrimination applied to both the signal and the noise. The time discriminator studied consists of a delay system which only transmited temporal information when the duration of the signal above the threshold was greater than the delay of the system. Author (NSA)

N73-18720# Hamburg Univ. (West Germany). II. Inst. fuer Experimentalphysik.
ACTIVITIES OF THE SECOND INSTITUTE FOR EXPERIMENTAL PHYSICS Annual Report 1971 [JAHRESPERICHT 1971]
Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Nov. 1972 110 p refs Partly in GERMAN and partly in ENGLISH Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-K-72-21) Avail: NTIS Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Leopoldshafen, West Ger. 22 DM

Work has been carried out on nuclear or elementary particle physics and solid state physics using the DESY synchrotron. In nuclear physics mainly reaction mechanisms, nuclear moments, and hyperfine interactions were studied. The experiments were done with the Hamburg 30 MeV-isochronous cyclotron, a 3 MeV van de Graaff generator, and radioactive sources. Work on elementary particle physics and solid state physics was done in close connection with corresponding research groups at DESY. Research was oriented toward production processes and reaction mechanisms of elementary particles, and the optical properties of solids in the far ultraviolet region. Author (ESRO)

N73-18721# Lund Univ. (Sweden). Dept. of Physics.
COMPOSITION OF LOW ENERGY COSMIC RADIATION FROM SILICON TO NICKEL
K. Soederstroem, S. Lindstam, S. Behrnetz, and K. Kristiansson Dec. 1972 29 p refs Sponsored in part by Swed. Atomic Res. Council and Swed. Nat. Sci. Res. Council
(LUIP-CR-72-16) Avail: NTIS HC $3.50

The charge composition of the cosmic radiation for the elements with Z > or = 14 was studied in a stack of nuclear emulsions. Particles stopping in the stack were measured with a nuclear track photometer to determine the charge. Relative abundances are given for the elements silicon to nickel. ESRO

N73-18722# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THEORETICAL MEINEL BAND RESEARCH Technical Report, 1 Oct. 1971 - 30 Jun. 1972
David C. Cartwright and Nicholas A. Fiamengo 15 Nov. 1972 88 p refs
(Contract F04701-72-C-0073)
(AD-753396; TR-0073(9260-01)-6; SAMSO-TR-72-292) Avail: NTIS CSCL 07/4

The purpose of the research was to try to develop an accurate theoretical model of the optical excitation, emission, and deactivation properties of the Meinel band system of N2(+). A brief review of the interest and objectives of this theoretical research is given and a model for the population of the Meinel bands is proposed. New lifetime data are analyzed by a nonlinear least-squares method to provide the transition moment and its dependence on the internuclear distance. Transition probabilities from v(1) = 0-10 of the A sq Pi u state are obtained and found to be significantly different than previously reported. Autoionization and quenching processes involving the A-state are discussed and reasonable estimates for the quenching rates of the A-state by N2 are given. Author (GRA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-18723*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
PLASMA PHYSICS ABSTRACTS Technical Report, 1 Jan. - 31 Dec. 1972
David C. Montgomery and Donald A. Gurnett 31 Dec. 1972 10 p refs
(Grant NGL-16-001-043)
(NASA-CR-130983) Avail: NTIS HC $3.00 CSCL 20I

Abstracts of publications in plasma physics are presented including theoretical and ionospheric research. F.O.S.

N73-18724*# California Univ., Los Angeles. Plasma Physics Group.
THE FORMATION OF ION ACOUSTIC SHOCKS
Roscoe B. White, Burton D. Fried, and Ferdinand V. Coroniti Jan. 1973 19 p refs
(Grant NGL-05-007-190; Contract N00014-69-A-0200-4023)
(NASA-CR-130994; PPG-142) Avail: NTIS HC $3.00 CSCL 20I

Recent experiments performed in the double plasma (DP) device have verified the existence of electrostatic ion acoustic laminar shocks. The influence of the piston on the shock structure is investigated by modeling the DP device and by numerically solving the temporal and spatial evolution of the shock. In order to isolate piston effects, as opposed to kinetic theory effects such as reflected ions and trapped electrons, the DP plasma is modeled as a cold ion fluid with isothermal Boltzmann electrons. It is shown that laminar shock transitions with structure agreeing with DP shock experiments can be excited. Author

N73-18725*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF AN ION-CYCLOTRON-WAVE PLASMA APPARATUS OPERATED IN THE RADIOFREQUENCY SUSTAINED MODE
Clyde C. Swett and Richard R. Woollett Washington Mar. 1973 43 p refs
(NASA-TN-D-7187; E-7213) Avail: NTIS HC $3.00 CSCL 20I

An experimental study has been made of an ion-cyclotron-wave apparatus operated in the RF-sustained mode, that is, a mode in which the Stix RF coil both propagates the waves and maintains the plasma. Problems associated with this method of operation are presented. Some factors that are important to the coupling of RF power are noted. In general, the wave propagation and wave damping data agree with theory. Some irregularities in wave fields are observed. Maximum ion temperature is 870 eV at a density of five times 10 to the 12th power cu cm and RF power of 90 kW. Coupling efficiency is 70 percent. Author

N73-18726# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

A LINEARIZED THEORY FOR MPD DUCT FLOWS WITH EXTERNAL MAGNETIC FIELDS AND HALL EFFECT
Klaus Robert 1972 53 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-67) Avail: NTIS HC $4.75; DFVLR Porz-Wahn: 15,80 DM

An examination is made of the steady, inviscid, and barotropic flow of a rarefied gas plasma through a cylindrical duct of finite length and nonconducting wall, under the influence of an imposed axially directed electric field and an axisymmetric external magnetic field, taking the Hall effect into account. Using continuum methods the problem is solved three-dimensionally, assuming both the magnetic Reynolds number and the Hall parameter are much smaller than one. By means of a perturbation method, closed form solutions for the electric current density, flow velocity, and mass density are derived in the case of weakly curved magnetic lines of force. Author

N73-18727# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A CRITICAL BETA SUB p IN A TORUS WITH RECTANGULAR CROSS SECTION
Y. Suzuki Oct. 1972 17 p refs
(IPPJ-141) Avail: NTIS HC $3.00

A simple diffused-boundary model is considered for magnetohydrodynamic equilibrium in an axisymmetric torus with rectangular cross section. The pressure balance equations are reduced from the expressions for eigenvalues of the equilibrium equation. The parameter beta sub p (ratio of plasma pressure to poloidal magnetic pressure) is closely related to the paramagnetism of plasma and geometrical factors. The condition of no reversed toroidal current gives the limitation on the paramagnetism and beta sub p. The critical beta sub p becomes largest for the square plasma cross section. Author

N73-18728# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NEW ELECTRON-WAVE AMPLITUDE OSCILLATION DUE TO AN INITIAL SPATIAL DISTURBANCE
Ryo Sugihara and Tetsuo Kamimura Nov. 1972 18 p refs
(IPPJ-143) Avail: NTIS HC $3.00

When an initial disturbance in a plasma is so strong that initial phase velocity and initial unperturbed distribution gradients are of the same order, the spatial inhomogeneity represented by the latter causes a new type of amplitude oscillation while the usual amplitude oscillation is not sensitive whether or not the phase velocity gradient equals zero. This is due to the fact that the initial spatial disturbance survives around phase velocity unsubjected to phase mixing for some time. The most remarkable feature of this oscillation is that this amplitude almost always remains larger than the initial one. Author

N73-18729# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ON-LINE CORRELATION MEASUREMENT IN A PLASMA
Atsushi Ogata and Kiyokata Matsuura Dec. 1972 32 p refs
(IPPJ-T-12) Avail: NTIS HC $3.75

An on-line system to calculate correlations in a plasma is developed. A combination of a fast buffer memory and a digital computer enables analysis of signals up to 4 MHz, with application to pulsed plasma diagnostics. Hardware and software aspects of the system are described (together) with (a few) applications. Author

N73-18730# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PERPENDICULAR ION CYCLOTRON RESONANCE IN A TWO-ION PLASMA
Hiroshi Toyama and Kiyokata Matsuura Dec. 1972 23 p refs
(IPPJ-146) Avail: NTIS HC $3.25

The RF power absorbed at the perpendicular ion cyclotron resonance of an H-D plasma is calculated using the model of an infinitely long coil, with electron density, ion temperature, and the H-D concentration ratio as the parameters. Author

N73-18731# Nagoya Univ. (Japan). Inst. of Plasma Physics.
OBSERVATION OF FREE-STREAMING OF ELECTRON IN PLASMAS
Y. Kawai, Y. Nakamura, T. Itoch, and T. Kawabe Dec. 1972 24 p refs Prepared in cooperation with Tokyo Univ.
(IPPJ-145) Avail: NTIS HC $3.25

The excitation and propagation of electron waves in a plasma were studied experimentally in a low density and large volume plasma. For frequencies larger than the electron Langmuir frequency, an electron plasma wave was observed which is predicted by the linear theory for a Maxwellian plasma. For smaller frequencies, free-streaming electron or ballistic signals are observed. For frequencies close to the electron Langmuir frequency, both the electron plasma wave and the free-streaming electrons are excited and show interference patterns. These observations are compared with the theoretical prediction. The effect of the free-streaming electrons on a sheath formed around a transmitter is also discussed. Author

N73-18732# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXPERIMENTAL TECHNIQUE TO MEASURE PHASE-SPACE DIAGRAMS IN PLASMA EXPERIMENTS
H. Ikezi and K. E. Lonngren Dec. 1972 12 p refs Submitted for publication Sponsored in part by NSF
(IPPJ-147) Avail: NTIS HC $3.00

An experimental technique is described which allows one to easily measure and rapidly display the particle distribution function in phase-space in nonlinear wave-plasma interaction experiments. An application to the study of pseudowaves is also presented. Author

N73-18733*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DOUBLE ELECTROSTATIC PROBE FOR MEASURING DENSITY, TEMPERATURE, AND VELOCITY OF A FLOWING PLASMA
Donald L. Chubb Washington Mar. 1973 22 p refs
(NASA-TN-D-7223; E-7281) Avail: NTIS HC $3.00 CSCL 20I

A method for obtaining plasma electron temperature and density, as well as the Mach number and flow velocity from the current-voltage characteristic of a flat-faced double probe, is presented. Calculated momentum fluxes of a flowing argon plasma obtained with this probe are compared with experimentally determined momentum fluxes. Reasonable agreement is obtained. Author

N73-18734# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research
BASIC FEATURES OF PLASMA INSTABILITIES
B. Lehnert 22 Oct. 1972 220 p refs
(TRITA-EPP-72-23) Avail: NTIS HC $13.00

The basic characteristics of various instability phenomena are outlined, including underlying analysis, general physical properties of unstable modes, corresponding energy sources and coupling mechanisms, as well as applied stabilization methods. A classification scheme is developed for a systematic subdivision of existing types of plasma disturbances, including both stable and unstable modes. Linear and nonlinear modes and associated loss mechanisms are discussed. The established classification scheme is applied in a systematic search for instability phenomena. Author (ESRO)

N73-18735# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
OPTIMIZATION OF THE WORKING CONDITIONS IN A PLASMA WIND TUNNEL BY-CONTROL OF THE PRESSURE DISTRIBUTION IN THE ACCELERATION SECTION Ph.D. Thesis - Tech. Hochschule Aachen [OPTIMIERUNG DER BETRIEBSBEDINGUNGEN IN EINEM PLASMAWINDKANAL DURCH KONTROLLE DER DRUCKVERTEILUNG IN DER BESCHLEUNIGUNGSSTRECKE]
Werner Zabka Sep. 1972 105 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-70) Avail: NTIS HC $7.25; DFVLR, Porz, West Ger. 28,40 DM

Theoretical and experimental investigations to develop a gas-inlet system for a traveling wave accelerator to be used in a plasma wind-tunnel and a propulsion device are described. As the plasma is generated and accelerated by a traveling wave, it was necessary to investigate the interaction between the plasma and the traveling wave by means of a theoretical model, in order to determine the optimal density distribution for effective acceleration. The development of a gas-inlet system which produces the theoretically determined density distribution and

provides the accelerator with a controllable mass flow of neutral gas during operation time is described. Author (ESRO)

N73-18736# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
MODEL OF A PARALLEL SHOCK WAVE WITH TURBULENT DISSIPATION IN A HOT PLASMA [MODELL EINER PARALLELEN STOS SWELLE MIT TURBULENTER DISSIPATION IN EINEM HEISSEN PLASMA]
R. D. Auer Jul. 1972 125 p refs In GERMAN
(MPI-PAE/Extraterr-69) Avail: NTIS HC $8.25

The model of a shock wave propagating parallel to an external magnetic field in a collisionless plasma, and prevented from disrupting and breaking by turbulent dissipation, is considered. The turbulent dissipation is limited to the garden hose instability, excited in the transition region of the shock wave. As this instability is nonresonant, a system of flow equations can be set up, which describe ion sound and Alfven waves of small amplitude, as well as the development of the instability and its quasilinear-stabilization. The numerical integration of the 12 coupled nonlinear partial differential equation leads to a good agreement with the quasilinear theory for the temporal development of the instability and the turbulent stationary shock profiles. It is shown that the shock wave velocity has a critical Mach number upper limit. ESRO

N73-18737# Technische Hochschule, Hanover (West Germany). Inst. fuer Plasmaphysik.
SPECTROSCOPIC METHODS FOR TEMPERATURE MEASUREMENTS IN PLASMAS WITH SELF-ABSORPTION [SPEKTROSKOPISCHE METHODEN ZUR MESSUNG DER TEMPERATUR IN PLASMEN MIT SELBSTABSORPTION]
D. Meiners Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Nov. 1972 96 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-K-72-22) Avail: NTIS Zentralstelle fuer Atomkernenergie - Dokumentation (ZAED), Leopoldshafen, West Ger. 18,70 DM

A survey is given of spectroscopic methods for measuring temperatures in plasmas with self-absorption. Special attention is given to those methods which enable determination of the complete radial temperature distribution in inhomogeneous plasma columns. Techniques for measuring the optical thickness and solving the integral equation for the local emission coefficient are discussed, and an ALGOL program for calculating the radial temperature is presented. Easily usable formulas are given for Bartels' method including induced emission and iterative improvement of the radial temperature distribution.
Author (ESRO)

N73-18738# European Space Research Inst., Frascati (Italy).
FREQUENCY SHIFT DUE TO RESONANT PARTICLE DIFFUSION IN VELOCITY SPACE
Marino Bornatici 1972 8 p refs Submitted for publication
Avail: NTIS HC $3.00

The effects of average orbit distortion and orbit dispersion on the frequency of an electrostatic mode for an ensemble of three dimensional turbulent, unmagnetized plasmas are considered. The effects are shown to be important because they can act as an amplitude-dependent stabilizing mechanism for waves which are linearly unstable. ESRO

N73-18739# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ANALYSIS OF FAST IONS IN A PENNING DISCHARGE IN A STRONGLY INHOMOGENEOUS MAGNETIC FIELD
Rolf B. Johansson May 1972 63 p refs
(TRITA-EPP-72-12) Avail: NTIS HC $5.25

A Penning discharge with a ring anode in a magnetic field of high mirror ratio operation in hydrogen of 3-12-10 to the minus 4 torr pressure was studied by measuring the cone of the discharge. The efflux of neutral particles, due to charge exchange, was measured with scintillation counters from different parts of the discharge volume, and then energy was analyzed. The momenta of ions impinging on the cathodes was also measured. Instrument geometry and the sampled plasma volume are considered, and results from measurements with discharge burning in the unsymmetrical mode are also given. ESRO

N73-18740# Royal Inst. of Tech., Stockholm (Sweden). Inst. of Plasma Physics and Fusion Research.
CENTRIFUGAL EXPANSION INSTABILITY OF A ROTATING PLASMA
B. Lehnert 5 Dec. 1972 26 p refs
(TRITA-EPP-72-28) Avail: NTIS HC $3.50

The high thermal pressure of a hot plasma is simulated by the large centrifugal force of a dense rotating plasma giving rise to equivalent beta values beta sub C exceeding 0.1 in laboratory experiments. The relationships between beta sub C and the induced azimuthal plasma currents and radial expansions of the magnetic field lines are determined in terms of simple models of the induced current distribution. A centrifugal expansion instability is shown to exist at sufficiently high beta values. This expansion instability provides a possible explanation of anomalous plasma behavior. ESRO

N73-18741# Royal Inst. of Tech., Stockholm (Sweden). Inst. of Plasma Physics and Fusion Research.
HIGH-BETA PLASMAS CONFINED IN POLOIDAL MAGNETIC FIELDS
B. Lehnert, T. Hellsten, and R. Raggi 22 Dec. 1972 32 p refs
(TRITA-EPP-72-33) Avail: NTIS HC $3.75

Experiments on rotating plasmas providing methods for studying the important problems of plasma equilibrium and stability at high beta values are described. The investigations were performed by means of probe and Rogowsky coil recordings. It was found that appreciable centrifugal forces can be generated in the plasma, corresponding to equivalent beta values as high as 20%. The outer boundary is strongly defined and the plasma behavior is consistent with a macroscopically stable state. ESRO

N73-18742# Naval Research Lab., Washington, D.C.
MAGNETIC FIELD GENERATION DUE TO RADIATION PRESSURE IN A LASER PRODUCED PLASMA
John A. Stamper Aug. 1972 22 p refs
(AD-748180; NPL-MR-2492) Avail: NTIS CSCL 20/9

Magnetic field generation, according to Faraday's Law, requires a solenoidal electric field. Solenoidal electric fields associated with the large pressure and temperature gradients existing in laser-produced plasmas have previously accounted for the conversion of plasma thermal energy into magnetic field energy. It is shown that, in addition to these thermal sources, radiation pressure gradients produce a solenoidal electric field and thus provide a non-thermal (not dependent on plasma heating) source so that there is a direct conversion of laser radiation energy to magnetic field energy. This also implies a non-thermal (no plasma heating) absorption of laser radiation. Author (GRA)

N73-18743# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTROSCOPIC AND PROBE STUDIES OF A LOW-PRESSURE JET
I. P. Garkusha, S. P. Polyakov, and V. I. Tverdokhlebov 27 Oct. 1972 12 p refs Transl. into ENGLISH from the publ. "Teplofizicheskie Svoistva Nizkotemperaturno; Plazmy" Moscow, 1970 p 125-128
(AF Proj. 4152)
(AD-752694; FTD-HT-23-1528-72) Avail: NTIS CSCL 20/9

Investigation of the physical properties of jets created by arc heaters is one of the urgent problems of new technology. Temperature is one of the most important physical quantities characterizing plasma jets. There are a number of works in which the temperature of jets has been determined. The purpose of the work is to measure electron temperature and excitation temperature in plasma jets stabilized by air and oxygen, and also to determine the concentration of charged particles.
Author (GRA)

N73-18744# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASURING THE ELECTRON TEMPERATURE BY A PROBE PROCEDURE IN GLOW-DISCHARGE PLASMA OF NITROGEN AND AIR UNDER AVERAGE PRESSURES
S. V. Rode and S. S. Vasilev 15 Sep. 1972 11 p refs Transl. into ENGLISH from the book "Teplofiz. Svoistva Nizkotem-

peraturnoi, Plazmy" Moscow, Izd-vo Nauka, 1970 p 7-10
(AF Proj. 4152)
(AD-752871; FTD-HT-23-888-72) Avail: NTIS CSCL 20/9

The accuracy of probe measurements and of two formulas describing conditions in the plasma was demonstrated. One formula is for the intensity of nitrogen spectral bands under average pressures of 20 to 250 mm Hg and under currents of 25 to 600 mA. The other formula is for the ratio of potential gradient to the induced pressure. Agreement was also obtained between experimental and theoretical values of the fraction of energy given off by an electron in each collision. N.E.N.

N73-18745# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THIRD ALL-UNION CONFERENCE ON THE PHYSICS OF LOW TEMPERATURE PLASMA
22 Sep. 1972 548 p refs Transl. into ENGLISH from Vsesoyuznaya Konf. po Fizike Nizkotemperaturnoi Plazmy, 3d (Moscow), 1971 p 1-509 Conf. held at Moscow, 21-25 Jun. 1971
(AD-753061; FTD-MT-24-1618-71) Avail: NTIS CSCL 20/9

The book consists of many papers presented at The Third All-Union Conference on the Physics of Low-Temperature Plasma during 1971. The first article deals with the review of results of investigations of physical properties of a new method for producing plasma, the photoresonant method. There are seven main headings under which the articles appear. They are: Methods of production and diagnostics; Thermodynamics; Transport and optical properties; Kinetics and nonequilibrium processes; Nonlinear phenomena, instabilities, turbulence; Magnetohydrodynamics; Phenomena on the plasma-solid boundary. GRA

N73-18746# New York Univ., N.Y. Dept. of Electrical Engineering and Computer Science.
COMPUTERS SIMULATED, NONLINEAR IMPULSE RESPONSE OF INHOMOGENEOUS PLASMA SLAB
Jeffrey N. Brooks and B. R. Cheo Oct. 1972 125 p refs
(Grant AF-AFOSR-2226-72; AF Proj. 9751)
(AD-753104; TR-402-11; AFOSR-72-2377TR) Avail: NTIS CSCL 20/9

The response of an inhomogeneous plasma to strong, initial impulse electric field excitation has been studied by means of a sheet model computer simulation. Runs were made for both cold and warm plasmas having a cosine like density background. Strong nonlinear effects are observed, as well as phenomena distinctly attributable to the inhomogeneity. These include a non-monotonic voltage decay rate, complex mode structure of the electric fields, and strong density peaks. An increase in thermalization occurs in all cases. Author (GRA)

N73-18747# California Univ., Los Angeles. School of Engineering and Applied Science.
MODAL FEEDBACK STABILIZATION OF HYDROMAGNETIC EQUILIBRIA
G. Rodriquez and P. K. C. Wang Sep. 1972 40 p refs
(Grant AF-AFOSR-2303-72; AF Proj. 9752)
(AD-753102; UCLA-ENG-7285; AFOSR-72-2290TR) Avail: NTIS CSCL 20/9

The problem of feedback stabilization of MHD instabilities is studied. Results are obtained for a cylindrical perfectly conducting plasma column immersed in a static axial magnetic field. Based on the linearized MHD equations, it is shown that local stabilization (including the interchange modes) can be achieved by a feedback control in the form of a magnetic field perturbation acting at the fluid boundary and depending linearly on the amplitudes of the unstable modes only. The control can be implemented by a finite number (a minimum of two in order to control all the unstable modes) of helical current-carrying conducting straps. The interchange modes can be stabilized by shielding each strap such that its field is effective on a portion of the plasma surface only. The limitations of the results are also discussed. Author (GRA)

N73-18748# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.
STUDY OF VORTEX ANNIHILATION AND NEUTRON PRODUCTION Final Scientific Report, 1 Oct. 1971 - 30 Sep. 1972
Winston H. Bostick, Vittorio Nardi, and William J. Prior Oct. 1972 11 p refs
(Grant AF-AFOSR-1842-70; AF Proj. 9752)
(AD-753107; SIT-P274; AFOSR-72-2426TR) Avail: NTIS CSCL 20/9

Highly-localized X-ray sources in the plasma focus are shown to be the central channels of toroidal vortices. The decay of the magnetic fields of these toroidal vortices generates electric fields which accelerate the electrons and deuterons to produce X-rays and neutrons. Estimated electron densities in the channel are 10 to the power of 20/cc and magnetic fields up to 100 megagauss are believed to exist there. A viable model for neutron and X-ray production in the pinch effect has now at last come forward. Author (GRA)

N73-18749# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETECTION OF DENSE RAPID ELECTRON FLOWS IN A DISCHARGE WITH A HOLLOW CATHODE
I. I. Bakaleinik 17 Nov. 1972 12 p refs Transl. into ENGLISH from Akad. Nauk Belo-russk. SSR, Ordena Trudovogo Krasnogo Znameni, Inst. Fiz, Vopr. Fiz. Nizkotemperaturnoy Plazmy (Minsk), 1970 p 236-239
(AF Proj. 4152)
(AD-753038; FTD-HT-23-1203-72) Avail: NTIS CSCL 20/9

The results of probe investigations of a pulse discharge with a hollow cathode in hydrogen at a pressure of 0.05 to 0.5 mm Hg and current densities up to 80 A per square cm were cited. The anomalous course of the volt ampere characteristic of a flat probe, situated within the cavity of a cold cathode near its surface, was revealed; this is explained by the presence of dense fluxes of fast gamma electrons. Author (GRA)

N73-18750# Hebrew Univ., Jerusalem (Israel). Dept. of Physics.
PLASMA PROPAGATION INTO LOW PRESSURE GAS AND PLASMA IN A MAGNETIC FIELD Final Scientific Report, 1 Feb. 1969 - 30 Jun. 1971
Asher S. Kaufman 31 Jul. 1972 16 p refs
(Contract F61052-69-C-0023; AF Proj. 8608)
(AD-753087; AFCRL-72-0673) Avail: NTIS CSCL 20/9

The report summarizes investigations of plasma phenomena related to the propagation of plasma into an ambient gas. The phenomena are: the solar wind, electro-static containment of an ionized gas, containment in crossed electric and magnetic fields and the positive column in a magnetic field. Author (GRA)

N73-18751# Wisconsin Univ., Madison. Mathematics Research Center.
AN EXTENSION OF THE MHD JEFFERY-HAMEL FLOW Technical Summary Report
K. B. Ranger Oct. 1972 18 p refs
(Contract DA-ARO(D)-31-124-462)
(AD-753149; MRC-TSR-1280) Avail: NTIS CSCL 20/9

An extension of the MHD Jeffery Hamel flow is found which exhibits laminar separation at one wall, even for vanishingly small Reynolds and magnetic Reynolds numbers. Author (GRA)

N73-18752# University of Southern Calif., Los Angeles. Dept. of Physics.
LOWERING OF THE IONIZATION POTENTIAL OF AN ATOM IN A HIGH TEMPERATURE AND HIGH DENSITY PLASMA
S. K. Srivastava and G. L. Weissler 1 Dec. 1972 21 p refs
(Contract N00014-67-A-0269-0014)
(AD-753247; USC-VACUV-131) Avail: NTIS CSCL 20/9

Lowering of the ionization potentials of hydrogen and carbon atoms immersed in a high temperature and high density thermal plasma generated in a Maecker-type wall stabilized arc have been estimated from the advance or shift of their respective series limits in the vacuum ultraviolet region of the spectrum for different electron densities and temperatures, making use of the Inglis-Teller criterion. The question of the validity of a critical electron density is discussed. In addition, the physical significance of using the shift of the series limit in the Saha equation as the term equivalent to the lowering of the ionization potential is also considered. Author (GRA)

N73-18753# Mission Research Corp., Santa Barbara, Calif.
ANALYTIC TREATMENT OF THE LINE RADIATION FROM

DENSE PLASMAS Final Report
Robert N. Wilson Dec. 1972 122 p refs
(Contract DASA01-71-C-0054; DASA Proj. NWER-HC-062)
(AD-753245; MRC-R-11; DNA-2956F) Avail: NTIS CSCL 20/9

An approximate analytical solution to the non-equilibrium radiation transport equation is obtained for a gaseous slab consisting of ions and electrons. The analytic expression for the spectral flux escaping the slab exhibits line inversion. The analytic results provide a convenient alternative to numerical integration of the transport equation and in addition provide insight about the physical roles of spatial diffusion and frequency diffusion effects in the transport of radiation through optically thick plasmas. The analytic formalism is applied to a semi-infinite slab and the results show the evolution of an inversion line into an absorption line. The problem of radiation incident on a slab is solved and the results show a peaking of the back scattered spectral flux. Conditions are derived for the onset of induced transparency of a slab to incident radiation. GRA

N73-18754# Houston Univ., Tex. Dept. of Physics.
LASER SCATTERING FROM THE DENSE PLASMA FOCUS Final Report
Melvin Eisner 15 Dec. 1972 8 p refs
(Grant AF-AFOSR-2117-71; AF Proj. 9751)
(AD-753705; AFOSR-72-2433TR) Avail: NTIS CSCL 20/9

Time resolved scattering spectra have been observed from a dense plasma focus (DPF) illuminated by a pulse of laser light. Scattering was observable from 10 nanoseconds prior to arrival of the collapse on axis and for an additional 50 nanoseconds. The frequency spectrum is markedly asymmetric about the laser frequency, a feature which is inconsistent with spectral expectations based on thermal particle distributions even if particle drifts or wave excitations are included. A model is postulated which attributes the asymmetry to lateral displacement of scattering region from the axis of the focus. Analysis based on this model yields radial collapse velocity, density, and ion temperatures. Noteworthy features are the absence of radial bounce, indication of axial jetting and the formation of an axial wake. Author (GRA)

N73-18755# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ENHANCED LASER SCATTERING AND BREMSSTRAHLUNG EMISSION FROM NONTHERMAL THETA-PINCH PLASMAS
Howard M. Stainer Oct. 1972 62 p refs
(Contract N00017-72-C-4401)
(AD-753404; APL-TG-1199) Avail: NTIS CSCL 20/9

The conditions under which enhanced scattering of far-IR laser radiation can be obtained from theta pinch plasma are studied. The scattering cross section is derived from kinetic theory using rigid rotor distributions to model the specific theta pinch plasma. Three types of bremsstrahlung -- free-free, magnetic wave-wave, and non-magnetic wave-wave -- are discussed and the power produced by each kind is computed and compared to the scattered power. For typical HCN laser power densities of the order of 10 watts/square cm, the bremsstrahlung considerably exceeds the scattered power in both the wideband and narrowband receiver cases. Author

N73-18756# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRIC CONDUCTIVITY OF A HIGH DENSITY XENON PLASMA
S. I. Andreev and V. E. Gavrilov 17 Nov. 1972 11 p refs Transl. into ENGLISH from the monograph "Voprosy" Minsk, 1970 p 284-251
(AF Proj. 4152)
(AD-753489; FTD-HT-23-1202-72) Avail: NTIS CSCL 20/9

The purpose of this work is to experimentally investigate the dependence of specific electric conductivity of xenon plasma on temperature under conditions of the high concentration of charged particles when the concept of Debye screening is not used. GRA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-18757*# Hughes Aircraft Co., Culver City, Calif. Equipment Engineering Div.
ELECTROMAGNETIC RADIATION SCREENING OF SEMICONDUCTOR DEVICES FOR LONG LIFE APPLICATIONS
Thomas C. Hall and William G. Brammer Dec. 1972 58 p refs
(Contract NAS8-28937)
(NASA-CR-124119) Avail: NTIS HC $5.00 CSCL 20L

A review is presented of the mechanism of interaction of electromagnetic radiation in various spectral ranges, with various semiconductor device defects. Previous work conducted in this area was analyzed as to its pertinence to the current problem. The task was studied of implementing electromagnetic screening methods in the wavelength region determined to be most effective. Both scanning and flooding type stimulation techniques are discussed. While the scanning technique offers a considerably higher yield of useful information, a preliminary investigation utilizing the flooding approach is first recommended because of the ease of implementation, lower cost and ability to provide go-no-go information in semiconductor screening. Author

N73-18758*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICAL SCREENING PROCEDURE FOR SOLID IONIC CONDUCTORS
Harold E. Kautz, Joseph Singer, William L. Fielder, and J. Stuart Fordyce Washington Mar. 1973 11 p refs
(NASA-TN-D-7146; E-7177) Avail: NTIS HC $3.00 CSCL 20L

An electrical screening method has been developed for preliminary evaluation of polycrystalline specimens of candidates for use as solid ionic conductive electrolytes in batteries. The procedure measures dielectric loss and capacitance, from which are calculated an ac conductivity attributed provisionally to ions and an activation energy for that conductivity. Electronic conductivity is directly measured. The screening procedure applied to sodium beta-alumina yielded acceptable values for conductivity and activation energy. Author

N73-18759*# Gulf General Atomic, San Diego, Calif.
DEVELOPMENT OF CHEMICALLY VAPOR DEPOSITED RHENIUM EMITTERS OF (0001) PREFERRED CRYSTAL ORIENTATION
L. Yang and R. G. Hudson 19 Feb. 1973 47 p refs
(Contract NAS3-15323)
(NASA-CR-121143; Gulf-GA-A12506) Avail: NTIS HC $4.50 CSCL 20L

Rhenium thermionic emitters were prepared by the pyrolysis of rhenium chlorides formed by the chlorination of rhenium pellets. The impurity contents, microstructures, degrees of (0001) preferred crystal orientation, and vacuum electron work functions of these emitters were determined as a function of deposition parameters, such as substrate temperature, rhenium pellet temperature and chlorine flow rate. A correlation between vacuum electron work function and degree of (0001) preferred crystal orientation was established. Conditions for depositing porosity-free rhenium emitters of high vacuum electron work functions were defined. Finally, three cylindrical rhenium emitters were prepared under the optimum deposition conditions. Author

N73-18760# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
ON THE OPTICAL, EPR, AND MASER PROPERTIES OF HEAT TREATED IRON AND CHROMIUM DOPED RUTILE
P. O. Andersson, A. Jelenski, and E. L. Kollberg 1972 193 p refs
(RR-107) Avail: NTIS HC $11.75

Information on how heat treatment influences various physical properties of iron- and chromium-doped rutile is presented. The spacegroup of rutile is D4h. Hence, it has one main four-fold symmetry axis (the c-axis) and perpendicular to the c-axis four

two-fold symmetry axes (positive and negative a-axes) and a reflection plane. Each titanium ion is surrounded by six oxygen ions, forming a distorted octahedron. Octahedra surrounding Ti(4+) ions lying in succeeding planes are identical except for a rotation of 90 deg around the c-axis. Thus, paramagnetic ions substituting for Ti(4+) ions occupy two magnetically nonequivalent sites (PI and PII). Ions in sites with the same symmetry as PI and PII as belonging to the magnetic complexes I and II, respectively, are discussed. Author

N73-18761# Stanford Univ., Calif. Center for Materials Research.
RESEARCH ON AMORPHOUS MATERIALS Final Technical Report, 1 Jun. 1970 - 31 May 1972
W. E. Spicer, A. Bienenstock, and R. H. Bube 31 May 1972 94 p refs
(Contract DAHC04-70-C-0044; ARPA Order 1562)
(AD-752798; CMR-72-17) Avail: NTIS CSCL 20/12

Contents: Materials perfection and sharp band edges in amorphous Ge and Si; Studies of Te and As2Se3; Studies of the GeTe system; Dependence of structure of amorphous germanium films on the angle of evaporation; Studies of amorphous Si; Structural studies in the Ge-S, Ge-Se and Ge-Te systems; Threefold coordinated model structure of amorphous GeS, GeSe and GeTe; The structure of chalcogenide glasses; Cu impurities in As2Se3; X-ray absorption edge spectroscopy studies; Photoconductivity in amorphous chalcogenides. GRA

N73-18762# Texas A&M Research Foundation, College Station.
CHARACTERIZATION OF CONDUCTION PROCESSES IN AMORPHOUS SEMICONDUCTORS Final Technical Report, 1 Jan. 1971 - 31 Aug. 1972
J. L. Stone 31 Aug. 1972 111 p refs
(Grant DA-ARO(D)-31-124-G49; ARPA Order 1562)
(AD-753053) Avail: NTIS CSCL 20/12

Several different samples of 2As2Se3-As2Te3, As2Se3, As2Te3, As2S3 and Si(3%) Ge(4%) As(38%) Te(55%) were used in photodielectric tests. However, none of the experiments, conducted at room temperature, 77K, or 4.2K, produced any photodielectric effect. Several reasons for the absence of positive results were analyzed, and it was decided that low optical absorption of the material, low mobility of free carriers, and short momentum relaxation time were the reasons which best explained the negative photodielectric tests. The thermally stimulated conductivity experiment provides a convenient way to investigate these hypotheses by investigating the trapping centers existing in the material under study. Samples of amorphous thin film As2Se3 were investigated in this manner. GRA

N73-18763# Virginia Univ., Charlottesville. Dept. of Physics.
MAGNETIC IMPURITIES AND BOUNDARY EFFECTS IN METALS AND SUPERFLUIDS Final Report
Vittorio Celli 15 Nov. 1972 13 p refs
(Grant AF-AFOSR-1830-70; AF Proj. 9761)
(AD-753100; AFOSR-72-2183TR) Avail: NTIS CSCL 20/12

The report lists all the papers published under an Air Force Contract and outlines the results obtained in the following areas: The effect of magnetic impurities on transport properties of metals and superconductors: The magnetic susceptibility of superconducting films near the transition temperature; The effect of roton-roton interactions on viscosity and light scattering in liquid He4 and their possible role in the liquid-solid transition; The theory of atom-surface interactions; The calculation of the dielectric response of a metal surface and of the properties of surface plasmons; and finally; The theory of high-velocity dislocation motion in a crystal at low temperatures.
Author (GRA)

N73-18764# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF INTRINSIC DEFECTS IN ZINC SELENIDE SINGLE CRYSTALS THROUGH HIGH-TEMPERATURE EQUILIBRIUM CONDUCTIVITY MEASUREMENTS
Jost-Ulrich Jahn 27 Oct. 1972 14 p Transl. into ENGLISH from 15th Intern. Wiss. Kolloquim, Tech. Hochschule, Ilmenau, East Ger., 1970 p 211-218
(AD-753043; FTD-HT-23-1583-72) Avail: NTIS CSCL 20/12

The concentration of intrinsic defects in undoped ZnSe-single crystals were investigated in the temperature range from 750C to 980C in connection with zinc partial pressure, which was varied between 700 Torr and 1 Torr. From the measurements, it followed that at high Zn partial pressure, a simple ionized self-donor, and at low Zn partial pressure a doubly ionized self donor, presumably Zn in interlattice space, is the dominating electrically active intrinsic defect in the high temperature equilibrium. The lattice energy for the simply ionized donor was determined to be approximately equal 1.64 eV. GRA

N73-18765# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTORADIOGRAPHY OF THE DEFORMED SURFACE OF SILICON AND GERMANIUM
A. G. Zhdanovich, V. I. Kryuk, and R. I. Mints 17 Nov. 1972 11 p refs Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (USSR), no. 1, 1971 p 147-149
(AD-753039; FTD-HT-23-1241-72) Avail: NTIS CSCL 20/12

Some results are presented obtained from experiments on autoradiography of a deformed surface of silicon and germanium of electron and hold conductivity type single crystal samples in the form of platelets which were first ground and polished. The deformation of their surface was done by abrasive treatment, and also by scratching with a hard alloy cutter. The autoradiograms of the surface were obtained under various conditions: after deformation at liquid N and room temperatures, after deformation during illumination and in darkness, and also after excitation of deformed samples by the passage through them of a constant current. Author (GRA)

N73-18766# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEMICONDUCTOR PHOTOCONVERTERS
A. M. Vasilev and A. P. Landsman 27 Sep. 1972 302 p refs Transl. into ENGLISH of the book "Poluprovodnikovye Fotopreobrazovateli" Moscow, Sovetskoye Radio, 1971 p 1-225
(AD-753063; FTD-HT-23-317-72) Avail: NTIS CSCL 10/2

An effort is made to generalize and systematize material connected with the operating principle and operational characteristics of photoelectric converters which are widely used at present as power-supply sources for space vehicles. The physical principles of the photovoltaic effect and the application of the theory for determination of volt-ampere characteristics and parameters of various types of photoconverters are outlined. Some new directions in photoelectric power engineering are discussed (thermo-photoconverters). Author (GRA)

N73-18767# Cornell Univ., Ithaca, N.Y. Dept. of Physics.
RESONANCE STUDIES IN METALS AND METALLIC COMPOUNDS Final Technical Report, 1 Oct. 1968 - 31 Jul. 1972
Donald F. Holcomb 31 Jul. 1972 7 p refs
(Grant DA-ARO(D)-31-124-G1071; DA Proj. 200-61102-B-11B)
(AD-752912; AROD-6028-16-P) Avail: NTIS CSCL 20/12

Work summarized here falls into two closely related but distinct areas (1) the NMR investigation of the properties of the cesium-graphite intercalation compounds, and (2) the experimental determination of the properties of electron systems in highly doped, disordered materials as the impurity concentration is changed and the materials cross over from insulating to metallic behavior. Author (GRA)

N73-18768# Yeshiva Univ., New York. Belfer Graduate School of Science.
MAXWELL R. MAYBAUM INSTITUTE FOR MATERIAL SCIENCES AND QUANTUM ELECTRONICS Quarterly Report
D. C. Mattis 15 Dec. 1972 42 p refs
(Contract N00014-68-A-0302-0005)
(AD-753270; QR-2) Avail: NTIS CSCL 20/12

The second quarterly progress report includes new results on crystal growth of FeS(x) and NbO2 and results on the field switching of single crystal NbO2. Author (GRA)

N73-18769# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
STRUCTURAL PROPERTIES OF AMORPHOUS SEMICON-

DUCTORS BY MOSSBAUER SPECTROSCOPY Semiannual Technical Report
Norman Blum 30 Nov. 1972 10 p refs
(Contract N00017-72-C-4401; ARPA Order 1562)
(AD-753272; SATR-1) Avail: NTIS CSCL 20/12

The Mossbauer technique provides a means for investigating short-range order and order-disorder transitions which are difficult to examine by other techniques. By correlating structural information with sample preparation variables and optical and electronic properties, a significant contribution to understanding the behavior and properties of amorphous semiconductors may be made. Current emphasis is being placed on observing the amorphous to crystalline transition in vacuum deposited Te films. Since crystallization occurs below room temperature (approximately 0 C), apparatus was constructed to deposit, transfer and examine films maintained at low temperature. Crystalline films of tellurium up to 18 microns thick have been deposited on room temperature beryllium substrates and Mossbauer spectra have been obtained. GRA

N73-18770# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
[PROGRESS IN ELECTRONICS RESEARCH, INCLUDING FREQUENCY AND ANTENNA STUDIES] Semiannual Progress Report, 1 Jan. - 30 Jun. 1972
Nov. 1972 68 p refs
(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-67-A-0298-0008)
(AD-753255; SAPR-84) Avail: NTIS CSCL 20/12

Contents: Very low frequency wave propagation; Electron and solid state physics; Control theory and applications; Electronic networks and instrumentation; Coupled antennas and arrays; Antennas and waves in dielectric conducting and plasma media; Scattering and diffraction; Antennas and transmission lines. GRA

N73-18771# California Univ., Irvine. Dept. of Physics.
INTERACTION OF SURFACE MAGNETOPLASMONS AND SURFACE OPTICAL PHONONS IN POLAR SEMICONDUCTORS
J. J. Brion, R. F. Wallis, A. Hartstein, and E. Burstein Jun. 1972 18 p refs Prepared in cooperation with Pennsylvania Univ., Philadelphia
(Contract N00014-69-A-0200-9003)
(AD-753484; TR-72-35) Avail: NTIS CSCL 20/12

A theoretical investigation was performed, concerning surface polaritons associated with surface magnetoplasmons coupled to surface optical phonons in polar semiconductors. The coupled mode frequencies are calculated for several orientations of the magnetic field relative to the surface and the direction of propagation in the large wave vector (unretarded) limit. Dispersion curves are calculated for the configuration in which the magnetic field is parallel to the surface and is perpendicular to the wave vector. Experimental possibilities for observing the interaction effects are discussed. Author (GRA)

N73-18772# Naval Weapons Lab., Dahlgren, Va. Advanced Systems Dept.
MICROWAVE PROPERTIES OF GERMANIUM AND SILICON WINDOWS
Robert W. Lothrop Sep. 1972 75 p refs
(AD-753466; NWL-TR-2815) Avail: NTIS CSCL 20/12

Theoretical analysis and on-the-bench tests were performed to determine the required doping levels for germanium and silicon to produce infrared windows with large attenuations to microwave energy in the 1 to 10 GHz range. An optimum doping level was determined where infrared signals were attenuated by only 3% above that for a higher purity sample, while microwave signals were attenuated by over 100 db with over 60% of this attenuation resulting from reflections on the window surface and not absorption within the doped window. Results, conclusions and potentialites are discussed. Author (GRA)

N73-18773# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TESTING A POINT DIPOLE ELECTRO-OPTIC MODEL BY AN APPLICATION TO LEAD TITANATE M.S. Thesis
August S. Sanchez Sep. 1972 72 p refs
(AF Proj. 8809)
(AD-753467; GEP/PH/72-19) Avail: NTIS CSCL 20/12

A molecular point-dipole model that has been used successfully to calculate ferroelectric and electro-optic properties of the perovskite barium titanate (BaTiO3) is further tested here by an application to lead titanate (PbTiO3). The model calculates lorentz factors by the method of Rama Rau and the crystal's internal electric fields by the Ewald method of lattice sums. The model further treats the polarizabilities of ions as field-dependent and simulates covalency in bonds by replacing the full ionic charge by an effective charge. The Kerr and Pockel electro-optic constants are determined by the anisotropy induced in the refractive index by an external electric field. Author (GRA)

N73-18774# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TRANSITION PROBABILITIES FOR THE MEINEL BAND SYSTEM OF N2(PLUS) Report, for 1 Nov. 1971 - 30 Jun. 1972
David C. Cartwright 15 Nov. 1972 37 p refs
(Contract F04701-72-C-0073)
(AD-753394; TR-0073(9260-01)-7; SAMSO-TR-72-289) Avail: NTIS CSCL 07/4

Newly measured natural lifetimes for vibrational levels 1-8 and 10 of the doublet Pi(u) state of N2(+) have been analyzed by a weighted, non-linear, least squares technique to extract the absolute transition moment and its dependence on internuclear distance. Both are considerably different from previous results and lead to different transition probabilities and oscillator strengths. Transition probabilities for both v' = 0 and 9 are obtained by interpolation of the electronic portion of the band strength and result in predicted values for the lifetimes of the v' = 0 and 9 levels. Author

N73-18775# Hughes Research Labs., Malibu, Calif.
APPLICATION OF NONLINEAR INTERACTIONS IN ACOUSTIC MEDIA TO MICROWAVE SIGNAL PROCESSING DEVICES Final Technical Report
Michael Waldner Nov. 1972 116 p refs
(Contract F30602-71-C-0196)
(AD-753168; RADC-TR-72-276) Avail: NTIS CSCL 09/5

Nonlinear interactions of surface waves in acoustic media can lead to the implementation of a number of signal processing functions. The work under the contract was directed toward the implementation of the convolution function using piezoelectric crystals, primarily lithium niobate, as the acoustic medium. The objective was to obtain broadband operation, to minimize spurious signals, to characterize the devices in this mode of operation, and to evolve a design theory for these devices. The development of suitable broadband input transducers and the design of the coupling structure were both major elements of the effort. Three devices were delivered as a result of the work; prime concentration was directed toward completion of a broadband device encompassing the frequency range of 95 to 180 MHz, with a convolution time of 15 microseconds. Narrower band devices operating at 195 MHz center frequency with a convolution time of 15 microseconds and at 146 MHz with a convolution time of 8 microseconds were also delivered. Author (GRA)

N73-18776# Stanford Univ., Calif. Electronic Labs.
THE METAL OXIDE SEMICONDUCTOR ANALOG SHIFT REGISTER AS AN IMAGE SENSOR
David W. Bigelow Nov. 1972 168 p refs
(Contract N00014-67-A-0112-0044)
(AD-753259; SU-SEL-72-050; SU-TR-4829-1) Avail: NTIS CSCL 09/2

The MOS Analog Shift Register (ASR) has been investigated because of the possible advantages that it offers over present image sensors. The primary advantage is the built-in self-scan feature of the ASR image sensor which requires no external shift register. A second possible advantage is that conventional MOS processing is used which should enable image sensors to be made at less cost. A third possible advantage is that the MOS ASR image sensor can operate at lower light levels than conventional bipolar image sensors. Thus, the MOS ASR is very attractive as an image sensor. The main attention in this study has been on the building and the modeling of single column MOS ASR image sensors. Through this work a very accurate

model of the MOS ASR has been formulated, from which it is possible to predict the performance of all MOS ASR's.
Author (GRA)

N73-18777# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
REMOVAL AND SEPARATION OF PARTICLES BY CRYSTALLIZATION Ph.D. Thesis
Vincent H. S. Kuo Feb. 1973 183 p refs
(Contract DAHC15-72-G-0007; ARPA Order 1623)
(AD-753056; USCEE-435) Avail: NTIS CSCL 07/4

Pushing and incorporation of foreign particles during solidification were studied. Trapping was favored by rapid freezing, a small amount of stirring, and the presence of gas bubbles at the interface, and by formation of an acute angle between the interface and the container. With faceted growth, trapping differed from grain to grain and was sometimes favored at a grain boundary. The temperature gradient had no effect on particle trapping. Particle mixtures were separated by slowly increasing the freezing rate. This is called particle chromatography. A theory was developed for nucleation of gas bubbles during crystallization.
Author (GRA)

N73-18778# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
STRUCTURE, PROPERTIES AND RADIATION SENSITIVITY OF ELECTRICALLY BISTABLE MATERIALS. THERMAL STABILITY OF As2Se3-As2Te3 GLASSES Semiannual Technical Report, 6 Feb. - 6 Sep. 1972
Derek B. Dove and Ronald E. Loehman 6 Sep. 1972 115 p refs
(Contract DAHC04-70-C-0024; ARPA Order 1562)
(AD-752993; TR-5) Avail: NTIS CSCL 20/12

The report contains some new measurements on the thermal stability of As2Se3-As2Te3 glasses in which multiple crystallization processes have been found by differential scanning calorimetry. Discussion is given of the structure of As2Se3 films by comparing intensity and rdf curves obtained experimentally with theoretical curves derived from a microcrystallite model. The data strongly indicates that a glassy network model is more in accord with the experimental rdf than a microcrystalline model. Continuation of the work on the interaction between As2Se3 and Cu support grids is indicative of the formation of Cu(2-x)Se upon heat treatment. Finally a review article on electron diffraction rdfs of amorphous films prepared for the Physics of Thin Films is included. Author (GRA)

N73-18779# Sperry Rand Research Center, Sudbury, Mass.
NONLINEAR ELECTROOPTIC Q-SWITCH MATERIALS Final Report, 1 Aug. 1971 - 30 Jul. 1972
Michael Kestigian Jul. 1972 81 p refs
(Contract DAAB07-71-C-0336; DA Proj. 1S6-62705-A-056)
(AD-752445; RRC-CR-72-14; ECOM-0336-2) Avail: NTIS CSCL 20/6

The objective of this program was to obtain a new electrooptic material suitable for Q-switching of visible and near infrared radiation at low repetition rates. The compounds KBa5Nb9Zr030 and Ba2LaLiNa2Nb10030 were observed to exhibit the tetragonal tungsten bronze structure. Barium strontium niobate in which the zirconium cation was isomorphously substituted for a portion of the niobium cation was also prepared. Tungsten bronze compounds were formulated and prepared of compositions KSr5TiNb9030, La3Li3Nb8Zr2030 and (Ba, Sr)Nb206 - BaLiNb5015. Single crystal growth studies were carried out by use of the direct-melt Czochralski technique. Ba2LaLiNa2Nb-10030, Ba(1-x)Sr(x)Nb206b were 0.25 - or + x - or + 0.75, (Ba, Sr)Nb206 - Ba2LiNb5015, Zr-doped (Ba, Sr)Nb206 and KBa5Nb9Zr030 single crystals were grown. Samples of dimensions and perfection for electrooptic evaluation studies were prepared in single crystalline form. Electrooptic, optical damage and dielectric studies of these new tungsten bronze structural type single crystals were performed and are described. Author (GRA)

N73-18780# Pennsylvania State Univ., University Park. Dept. of Physics.
BOUNDARY SCATTERING OF PHONONS IN GERMANIUM AND SILICON Interim Technical Report
D. R. Frankl and George J. Campisi 6 Dec. 1972 9 p refs
(Contract N00014-67-A-0835-0015)
(AD-753494; TR-9) Avail: NTIS CSCL 20/12

Measurements of low-temperature thermal conductivity have been made on high-purity Ge single-crystal samples with various degrees of surface polish, to complement similar measurements previously reported on silicon. As a result of the more pronounced isotopic impurity content, bulk scattering could not be completely eliminated even in our thinnest (approximately 0.5 mm) and roughest samples. Accordingly, a Calloway-type analysis was used in order to extract the boundary-limited mean free path.
Author (GRA)

N73-18781# Maryland Univ., College Park. Engineering Materials Group.
CRACK SIZE AND GRAIN SIZE DEPENDENCE OF THE BRITTLE FRACTURE STRESS
Ronald W. Armstrong Dec. 1972 13 p refs
(Contract N00014-67-A-0239-0011; NR Proj. 031-739)
(AD-753525; EMG-109; TR-7) Avail: NTIS CSCL 20/12

The tensile brittle fracture, sigma sub c, dependence on crack size, c, is well approximated over a range of crack sizes by the relationship sigma sub c is approximately equal to sigma sub(o sub c) and (k sub c)(c to the minus 1/2 power where sigma sub) (o sub c) and k sub c are experimental constants. The positive value of sigma sub (o sub c) differentiates this relationship from the Irwin-Orowan expression. Some theoretical basis for sigma sub (o sub c) stems from the Bilby-Cottrell-Swinden expression for continuum cracking and from the Hall-Petch stress-grain size analysis for the fracture of polycrystals.
Author (GRA)

N73-18782# California Univ., Riverside. Dept. of Physics.
THICKNESS DEPENDENCE OF HOPPING TRANSPORT IN A-Ge FILMS
M. Pollak, M. L. Knotek, T. M. Donovan, and H. Kurtzman Nov. 1972 12 p refs
(Contract N00014-69-A-0200-5005; NR Proj. 017-664)
(AD-753827) Avail: NTIS CSCL 20/12

The conductivity of gas free thin films of a-germanium was measured as a function of temperature and of film thickness. Existing theories of hopping conduction have been modified to apply to the very thin films. The results obtained are very consistent with the experimental data, indicating strongly that hopping conduction near the Fermi energy is the conduction mechanism responsible for the conductivity below room temperature. The comparison between the experimental results and the theoretical predictions permits separate evaluation of the radius a of the localized wave functions at the Fermi energy, and the density of states at the Fermi energy. Author (GRA)

N73-18783# Maryland Univ., College Park. Dept. of Physics and Astronomy.
CARRIER SCATTERING AND FERMIOLOGY IN FERROMAGNETIC CONDUCTORS Semiannual Report, 1 May - 1 Nov. 1972
S. M. Bhagat and J. R. Anderson 1 Nov. 1972 34 p refs
(Contract N00014-67-A-0239-0024)
(AD-753841) Avail: NTIS CSCL 20/12

The report discusses topics on: Ferromagnetic resonance in iron at high temperatures, Ferromagnetic resonance in hcp Co at low temperatures, and dHvA effect in hcp cobalt. GRA

N73-18784# California Univ., Riverside. Dept. of Physics.
THE dc CONDUCTIVITY OF AMORPHOUS GERMANIUM AND THE STRUCTURE OF THE PSEUDOGAP
M. Pollak, M. L. Knotek, H. Kurtzman, and H. Glick Nov. 1972 16 p refs
(Contract N00014-69-A-0200-5005)
(AD-753824) Avail: NTIS CSCL 20/12

The authors attempt to relate the dc conductivity of amorphous germanium to the structure of the pseudogap. The report presents arguments and evidence against the often stated opinion that the (1/T)to the -4th power dependence of the dc conductivity cannot be accounted for by Mott's variable range hopping model. Author (GRA)

N73-18785# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Apr. - 30 Jun. 1972
W. Murray Bullis Dec. 1972 61 p refs
(Contract F29601-71-C-0002)
(AD-753642; NBS-TN-743) Avail: NTIS MF $0.95; SOD HC $1.00 as C13.46:743 CSCL 20/12

The quarterly progress report, sixteenth of a series, describes NBS activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices. Significant accomplishments during this reporting period include verification of the applicability of resolution of forces in interpreting pull test measurements on unannealed wire bonds on single-level substrates, completion of the feasibility study of ribbon-wire bonding, and development of test procedures in preparation for studies of high-frequency measurements of transistors on the wafer by means of probes. Work is continuing on measurement of resistivity of semiconductor crystals; study of gold-doped silicon; development of the infrared response technique; evaluation of wire bonds and die attachment; and measurement of thermal properties of semiconductor devices, delay time and related carrier transport properties in junction devices, and noise properties of microwave diodes.
Author (GRA)

N73-18786# Maryland Univ., College Park. Dept. of Electrical Engineering.
THE STUDY OF THE INTERACTION OF INTENSE PICOSECOND LIGHT PULSE WITH MATERIALS: OBSERVATION OF THREE PHOTON CONDUCTIVITY IN CdS WITH MODE-LOCKED Nd GLASS LASER PULSES Quarterly Technical Report, 22 Jun. - 21 Sep. 1972
S. Jayaraman and Chi H. Lee 1 Nov. 1972 15 p refs
(Grant DA-ARO(D)-31-124-72-G82; ARPA Order 675)
(AD-753677; TR-011) Avail: NTIS CSCL 20/12

The photoconductivity in CdS single and polycrystals was investigated by using mode-locked Nd glass laser pulses for excitation and was found to exhibit a power law I to the 3.0 plus or minus 0.2 power, where I is the peak excitation intensity. The three-photon absorption coefficient estimated from the photoconductivity measurement agreed well within an order of magnitude with the theoretical values. Author (GRA)

N73-18787# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEMPERATURE DEPENDENCE OF DIFFRACTED BEAM INTENSITIES OF SLOW ELECTRONS AS CRITERIA OF SURFACE PURITY
An Tuan Khoang and G. K. Zyryanov 24 Nov. 1972 11 p refs Transl. into ENGLISH from Vestn. Leningrad. Univ., Fiz., Khim. (Leningrad), v. 26, no. 4, 1971 p 143-146
(AF Proj. 7351)
(AD-753556; FTD-HT-23-1236-72) Avail: NTIS CSCL 20/12

The temperature dependence of the intensity, I, of a diffracted beam of electrons from plane (100) of PbS was studied as a function of slight impurities on the surface. For specimens in which the residual gases were frozen, log I decreased linearly as the temperature increased from -100 to 200 degrees. But, in the presence of residual gases of about 10-anion(5) mm Hg, log I at temperatures smaller than 0 degrees varies sufficiently to be an indication of the purity of the surface. Author (GRA)

N73-18788# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELUCIDATION OF SATELLITE LINES IN THE EPR SPECTRUM OF MANGANESE DOPED ZINC SELENIDE SINGLE CRYSTALS
Guenter Hartung and Wolgang Graf 1 Nov. 1972 9 p Transl. into ENGLISH from Proc. of 15th Intern. Wiss. Kolloquium, Tech. Hochschule Ilmenau, 1970 p 195-198
(FTD Proj. T65-05-32)
(AD-753507; FTD-HT-23-1582-72) Avail: NTIS CSCL 20/12

ZnSe single crystals, doped with 1% Mn show, besides 30 lines of the main EPR spectrum, several groups of 6 lines on both ends of the main signal. The main signal is explained by replacement of Zn(2-) by Mn(2-); the satellite lines result from a partial replacement of Se(2-) by a single valent anion such as Cl(-). This causes in addition to the cubic structure a trigonal structural element. Author (GRA)

N73-18789# Stanford Univ., Calif. Center for Materials Research.
MATERIALS RESEARCH Final Annual Report, 1 Jul. 1971 - 30 Jun. 1972
Nov. 1972 319 p refs
(Contract DAHC15-67-C-0218)
(AD-753845; CMR-72-18; AR-11) Avail: NTIS CSCL 20/12

The report includes information briefly describing materials science and engineering research activities at Stanford University during the period July 1, 1971 through June 30, 1972.
Author (GRA)

N73-18790# Illinois Univ., Urbana. Coordinated Science Lab.
HIGH AND LOW BIAS EFFECTS IN TUNNEL JUNCTIONS: IN PARTICULAR THE SYSTEM DYSPROSIUM-DYSPROSIUM OXIDE-LEAD
James Everett Robinson May 1972 146 p refs
(Contract DAAB07-67-C-0199)
(AD-753847; R-561; UILU-ENG-72-2222) Avail: NTIS CSCL 20/12

Observations of the superconducting energy gap structure in di/dV-V plots has verified the successful fabrication of Dy-Dy oxide-Pb tunnel junctions. These junctions are characterized using tunneling spectroscopy and calculations based on various models of the junction potential. Author (GRA)

N73-18791# Connecticut Univ., Storrs. Dept. of Physics.
INTERACTION OF HEAT, LIGHT AND DEFECTS IN SOLIDS Final Report, 1 Oct. 1971 - 30 Sep. 1972
Paul G. Klemens Nov. 1972 12 p refs
(Grant AF-AFOSR-2216-72; AF Proj. 9761)
(AD-753698; AFOSR-72-2232TR) Avail: NTIS CSCL 20/12

The report describes theoretical studies on the stimulated emission of phonons by intense laser light beams in the immediate vicinity of surfaces. Surfaces do not lower the intrinsic damage threshold. Also described are a calculation of the effect of nitrogen platelets on the thermal conductivity of diamond, a study on the thermal conductivity of complex crystals at elevated temperatures, calculations of phonon scattering and lattice thermal conductivity in ordered alloys, and an improved perturbation theory. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-18792# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
INVESTIGATION OF VARIOUS GRAIN CONFIGURATIONS CONCERNING A POLYETHYLENE/FLOX-70-HYBRID ENGINE. PART 1: SYSTEM BEHAVIOR AND SELECTION OF OPTIMAL GRAIN CONFIGURATIONS
R. Buchheim and H. Weiler 1972 59 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-60-Pt-1) Avail: NTIS HC $5.00; DFVLR Porz-Wahn: 19,70 DM

For the design of an optimal PAS-Hybrid-Engine various propellant grain configurations were investigated. A computer program was used to find an optimum grain geometry. Experiments were conducted with an annular geometry and with a cartwheel geometry using polyethylene/FLOX engines. Finally the validity of experimentally derived regression rate laws for engines employing different grain configurations and thrust levels was investigated. Author

N73-18793# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
INVESTIGATION OF VARIOUS GRAIN CONFIGURATIONS CONCERNING A POLYESTHYLENE/FLOX-70-HYBRID

ENGINE. PART 2: EXPERIMENTAL PERFORMANCE
H. Weiler and R. Buchheim 1972 45 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-61-Pt-2) Avail: NTIS HC $4.25; DFVLR Porz-Wahn: 15,90 DM

The performance of a hybrid FLOX-70/Polyethylene rocket engines of 400 N thrust and a multiport fuel grain geometry (cartwheel) has been investigated experimentally. A combustion efficiency of 97% and an impulse efficiency of 94% have been achieved. The variation of various operating parameters such as thrust, chamber pressure, mixing ratio and burnout with time was investigated in firings of up to 35 seconds. Author

N73-18794*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EXPERIMENTAL EVALUATION OF METALLIC DIAPHRAGMS FOR POSITIVE FUEL EXPULSION IN THE ATMOSPHERE EXPLORER, HYDRAZINE PROPULSION SUBSYSTEM
William L. Woodruff Feb. 1973 14 p ref Presented at the Monopropellant Propulsion Specialist Session of the JANNAF Propulsion Meeting, New Orleans, 28 Nov. 1972
(NASA-TM-X-66191; X-763-73-63) Avail: NTIS HC $3.00 CSCL 21I

Four Arde conospheroid metallic diaphragms were tested at NASA to evaluate their capability for use in the orbit adjust propulsion subsystem (OAPS) of the Atmosphere Explorer spacecraft (AE's C, D, and E). The diaphragms will be used for positive propellant expulsion and spacecraft center of mass (c.m.) control. A leak-free cycle life capability of nine reversals was demonstrated. The diaphragms rolled smoothly from ring to ring in a predictable manner on the first reversal. Varying amounts of diaphragm cocking and ring skipping were observed on subsequent reversals. The diaphragm pressure differential did not exceed 10 psid during any reversal. Cycle life capability, reversal mode, and pressure differential were not affected by sudden reversals, environmental tests, or 18,000 partial reversals. An expulsion efficiency of approximately 97 percent was demonstrated. The results of these tests show that metallic diaphragms can be used as an effective means of positive fuel expulsion; however, to achieve spacecraft c.m. control, the diaphragm must not be reversed prior to flight. Author

N73-18795# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
NON-STEADY COMBUSTION OF SOLID PROPELLANTS
R. A. Battista, L. H. Caveny, and M. Summerfield Oct. 1972 113 p refs
(Contract N00014-67-A-0151-0023)
(AD-753835; AMS-1049) Avail: NTIS CSCL 21/9

Solid rocket performance during rapid pressure excursions differs greatly from predictions based on steady-state burning rate data. Rapid pressurization (150 to 250 kpsi/sec) following a sudden throat area decrease in a low L star combustor produces pressure overshoots of 10% and indicated burning rate overshoots in excess of 50%. A transient internal ballistics model was developed incorporating nonsteady continuity and energy equations for the chamber, nonsteady energy equation for the propellant condensed phase, and a modified Zeldovich heat feedback function for the propellant (which for the conditions considered is known to burn a thin quasi-steady reaction zone). Sensitivity analyses using the model indicate that accurate surface temperature and temperature sensitivity data are needed.
Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-18796*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE LOW PRESSURE AUXILIARY PROPULSION SUBSYSTEM DESIGN DEFINITION: DESIGN HANDBOOK
A. E. Bruns and J. G. Gray 29 Jan. 1971 78 p ref
(Contract NAS9-11012)
(NASA-CR-130796; MDC-E0301) Avail: NTIS HC $6.00 CSCL 21H

A detailed description of recommended low pressure auxiliary propulsion subsystems (APS) for a space shuttle orbiter and booster is presented. The APS designs are the product of a study to identify and evaluate APS concepts, and to perform in-depth design and performance analyses for the most attractive of these. Selected APS baselines use the main engine propellant tanks as low pressure gas accumulators. For the orbiter, propellants from separate liquid tanks are used for main engine tank resupply. Resupply propellants are first circulated through tubular, passive heat exchangers, where they are vaporized and superheated prior to injection into the main engine tanks. Warm propellant vapors from the main engine tanks are mixed with additional liquid propellants in a downstream liquid/vapor mixer and supplied to the engines at constant temperature and pressure (constant density). The booster APS requires no separate propellant storage, since propellant residuals, trapped in the main engine tanks following boost, are sufficient to meet APS propellant demands.
Author

N73-18797*# Pratt and Whitney Aircraft, West Palm Beach, Fla.
STUDY OF INDUCER LOAD AND STRESS, VOLUME 2 Final Report
Nov. 1972 229 p refs Revised 3 Vol.
(Contract NAS3-11216)
(NASA-CR-72712-Vol-2-Rev; PWA-FR-3704-Vol-2-Rev) Avail: NTIS HC $13.50 CSCL 21H

A program of analysis, design, fabrication and testing has been conducted to develop computer programs for predicting rocket engine turbopump inducer hydrodynamic loading, stress magnitude and distribution, and vibration characteristics. Methods of predicting blade loading, stress, and vibration characteristics were selected from a literature search and used as a basis for the computer programs. An inducer, representative of typical rocket engine inducers, was designed, fabricated, and tested with special instrumentation selected to provide measurements of blade surface pressures and stresses. Data from the tests were compared with predicted values and the computer programs were revised as required to improve correlation. For Volume 1 see N71-20403. For Volume 2 see N71-20404. Author

N73-18798# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Luftsaugende Antrieb.
THE RECIRCULATION FLOW PATTERN OF A VTOL LIFT ENGINE
E. Schwantes 1972 165 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-50) Avail: NTIS HC $10.25; DFVLR Porz-Wahn: 29 DM

A method is presented to predict theoretically the increase of temperature due to wind-recirculation in the inlet of a VTOL lift engine exhausting normally to the ground. It is shown how to calculate with the potential-theory the velocities in the recirculation flow and how to determine the temperatures with the laws of spread of buoyant plumes. Many model-investigations are done to check these results. During this, the three regions of a VTOL propulsion jet, the free jet, the wall jet, and the zone of separation of the wall jet from the ground, due to wind effects and buoyancy forces are investigated at model-jets with critical nozzle pressure ratio and temperatures up to 1000 C.
Author

N73-18799# National Aerospace Lab., Tokyo (Japan).
DIGITAL CONTROL OF JET ENGINES. 1: CONTROL SYSTEM AND PRELIMINARY EXPERIMENTS
Kenji Nishio, Masanori Endo, Nanahisa Giyama, Takeshi Koshinuma, Toshimi Hata, Yukio Matsuda, Akira Yoshida, and Susumu Nakayama 1972 60 p refs In JAPANESE; ENGLISH summary
(NAL-TR-281) Avail: NTIS HC $5.00

The application of integrated circuit technology to the electronic control of jet engines is discussed. The analog and digital types of control systems are compared on the basis of flexibility, reliability, manufacturing costs, and producibility. The software and hardware involved in a jet engine control system using a digital computer are described. Author

N73-18800*# Aerojet Liquid Rocket Co., Sacramento, Calif.
HYDROGEN-OXYGEN AUXILIARY PROPULSION FOR THE SPACE SHUTTLE. VOLUME 1: HIGH PRESSURE THRUSTERS Final Report
30 Jan. 1973 546 p refs
(Contract NAS3-14354)
(NASA-CR-120895) Avail: NTIS HC $29.50 CSCL 21H

Technology for long life, high performing, gaseous hydrogen-gaseous oxygen rocket engines suitable for auxiliary propulsion was provided by a combined analytical and experimental program. Propellant injectors, fact response valves, igniters, and regeneratively and film-cooled thrust chambers were tested over a wide range of operating conditions. Data generated include performance, combustion efficiency, thermal characteristics film cooling effectiveness, dynamic response in pulsing, and cycle life limitations. Author

N73-18801*# Aerojet Liquid Rocket Co., Sacramento, Calif.
HYDROGEN-OXYGEN AUXILIARY PROPULSION FOR THE SPACE SHUTTLE. VOLUME 2: LOW PRESSURE THRUSTERS Final Report
30 Jan. 1973 159 p ref
(Contract NAS3-14354)
(NASA-CR-120896) Avail: NTIS HC $10.00 CSCL 21H

An abbreviated program was conducted to investigate igniter, injector, and thrust chamber technology for a 10.3 N/cm2 (15 psia) chamber pressure, 6660 N (1500 lbf) gaseous H2/O2 APS thruster for the Space Shuttle Vehicle. Successful catalytic igniter tests were conducted with ambient and cold propellants. Injector testing with a heat sink chamber (MR = 2.5, area ratio = 5.0) gave a measured specific impulse of 386 sec with 11% of the fuel used as film coolant. This coolant flow rate was demonstrated to be more than adequate to cool a spun adiabatic wall, flightweight thrust chamber. Author

N73-18802*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY COST AND MISSION VALUE COMPARISONS FOR PLANETARY PROBES DELIVERED BY ADVANCED PROPULSION SYSTEMS
Frank J. Hrach and Edward A. Willis Washington Mar. 1973 34 p refs
(NASA-TM-X-2751; E-7247) Avail: NTIS HC $3.00 CSCL 21F

The three advanced propulsion systems analyzed are an advanced chemical system, an improved solid-core nuclear rocket engine with a 25-kilowatt auxiliary powerplant, and a nuclear-electric system. The comparison of these systems is made on the basis of transportation cost divided by the expected value of the data returned to earth. The analysis shows that for the Mercury Orbiter mission and for missions to the outer planets with a high data requirement, the nuclear-electric system emerges as the best system. For the Venus Orbiter mission, the advanced chemical propulsion system is best. Author

N73-18803*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL AND EXPERIMENTAL PERFORMANCE OF OPTIMAL CONTROLLER DESIGNS FOR A SUPERSONIC INLET
John R. Zeller, Bruce Lehtinen, Lucille C. Geyser, and Peter G. Batterton Washington Mar. 1973 87 p refs
(NASA-TN-D-7188; E-7173) Avail: NTIS HC $3.00 CSCL 20D

The techniques of modern optimal control theory were applied to the design of a control system for a supersonic inlet. The inlet control problem was approached as a linear stochastic optimal control problem using as the performance index the expected frequency of unstarts. The details of the formulation of the stochastic inlet control problem are presented. The computational procedures required to obtain optimal controller designs are discussed, and the analytically predicted performance of controllers designed for several different inlet conditions is tabulated. The experimental implementation of the optimal control laws is described, and the experimental results obtained in a supersonic wind tunnel are presented. The control laws were implemented with analog and digital computers. Comparisons are made between the experimental and analytically predicted performance results. Comparisons are also made between the results obtained with continuous analog computer controllers and discrete digital computer versions. Author

N73-18804# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE SUPERSONIC COMPRESSOR RESEARCH AT THE VON KARMAN INSTITUTE FOR FLUID DYNAMICS
Frans A. E. Breugelmans Jun. 1972 46 p refs
(Grant AF-AFOSR-2104-71; AF Proj. 7065)
(AD-752583; ARL-72-0179) Avail: NTIS CSCL 21/5

The basic principles of the supersonic cascade and wheel are described. A series of blade profiles and supersonic wheels developed at the VKI are discussed and the progress due to the research effort is emphasized. Author (GRA)

N73-18805# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE LOW HUB-TIP RATIO SUPERSONIC AXIAL-FLOW COMPRESSOR, VOLUME 1 Final Report, 1 Jul. 1971 - 30 Jun. 1972
Frans A. E. Breugelmans Jun. 1972 52 p refs
(Grant AF-AFOSR-2104-71; AF Proj. 7065)
(AD-752585; VKI-IN-40-Vol-1; ARL-72-0180) Avail: NTIS CSCL 21/5

The report describes the test results of a supersonic axial flow compressor stage with a tip Mach number of 2.0. Volume I discusses especially the inlet stall, the associated flow field and the stage performance. Methods are proposed to eliminate the stall problem. Author (GRA)

N73-18806# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.
STATE-OF-THE-ART REVIEW OF TURBINE ENGINE INLET NOISE Final Technical Report
Robert B. Benham Nov. 1972 160 p refs
(AD-753000; NAPTC-PE-6) Avail: NTIS CSCL 21/5

The report points out that turbine-type engine design is evolving in a direction which will make fan and compressor turbomachinery noise continually more obstrusive. The TF34 engine is representative of state-of-the-art high bypass ratio subsonic turbofan technology. It contains no inlet noise-suppression design and the inlet noise exceeds Federal Air Regulation Part 36 take-off sideline noise limits by about 6PNdb. There are descriptions and theoretical presentations explaining the principal mechanisms producing the three inlet noise contributors; interaction tones, combination tones, and broad-band radiation. It is shown that noise control can be affected either at the rotor-stator source or with nacelle installation attenuation. Author (GRA)

N73-18807# United Technology Center, Sunnyvale, Calif.
SUPPRESSION OF COMBUSTION INSTABILITY IN ROCKET MOTORS USING ELECTROTHERMAL ACOUSTICS
R. W. Hermsen, W. R. Babcock, and A. G. Cattaneo Oct. 1972 43 p refs
(Contract F44620-69-C-0119; AF Proj. 9711)
(AD-753111; UTC-2356-FR; AFOSR-72-2055TR) Avail: NTIS CSCL 20/1

It was previously demonstrated that a conductive flame with a suitable arrangement of electrodes and coupling circuitry can transform an electrical signal into a high level acoustic output at audible and ultrasonic frequencies. Experimental evidence also indicated that complex effects involving the optical and electromagnetic spectrum took place concurrently. The objective of this research was to obtain a fundamental understanding of the observed phenomena to allow evaluation of potential applications in the fields of combustion instability, noise suppression, ultrasonic sound generation, communications and RF effects. Data on the acoustic, optical, electrical, and microwave scattering properties of a seeded oxygen-acetylene flame were obtained

over the frequency range up to 150 kHz. A theoretical model was developed which correctly predicts the frequency dependent electrical impedance of the flame and the amplitude and directivity of the external sound field. Author (GRA)

N73-18808# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
CALCULATION OF THE THREE DIMENSIONAL PARTICLE TRAJECTORIES IN A TURBINE STAGE
M. Fathy Hussein and W. Tabakoff Sep. 1972 71 p refs
(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-753364; Rept-72-33; AROD-T-4-51-E) Avail: NTIS CSCL 21/5

The equations of motion, in three dimensions, of solid particles entrained by a gas flow through the stationary and rotating cascades of a turbine are derived. The gas velocity components and density at all the mesh points of a square grid constructed in the flow channels are computed assuming a compressible flow. Formulas to determine the proper drag on the particles for a wide range of Reynolds numbers are given. A gas particle flow tunnel is used to investigate experimentally the phenomenon of particle impact with the turbine blades or casing and their rebound from these walls. Formulas for the restitution ratio due to collision and the rebound to incidence angle ratio are derived. This information is used in the equations of motion of the solid particles. Author (GRA)

N73-18809# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS-DYNAMIC VERIFICATION CALCULATION OF AXIAL FLOW MULTISTAGE COMPRESSORS ON EDC
A. P. Tunakov and S. G. Ibragimov 1 Nov. 1972 22 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Kazan), no. 114, 1970 p 31-47
(AD-753519; FTD-MT-24-1501-72) Avail: NTIS CSCL 21/5

An algorithm for testing the gas dynamic design of axial-flow compressors, particularly in the final adjustment phase, is proposed. Particularly well suited for calculating the parameters of blade rings, the procedure is suitable for use in the design phase if data on the loss coefficients in empirical formulas have been established. Author (GRA)

N73-18810# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY OF AN INJECTOR WITH A HIGH-FREQUENCY SWIRL GENERATOR
V. N. Chernykh 22 Sep. 1972 12 p Transl. into ENGLISH from Inst. Inzh. Zheleznodorozhnogo Transp., Leningrad, Sb. Tr. (Leningrad), no. 307, 1970 p 95-102
(AD-751079; FTD-MT-24-1113-72) Avail: NTIS CSCL 21/7

Results are presented from a study of an injector with a high frequency swirl generator. Droplet size was derived as a function of pressure and ratio of air and liquid consumption levels. Results are also presented of experiments determining the density of reflux and jet taper angle. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-18811*# Washington Univ., St. Louis, Mo. Lab. for Space Physics.
RELATIVISTIC HEAVY COSMIC RAYS
R. A. Mewaldt, J. I. Fernandez, M. H. Israel, J. Klarmann, and W. R. Binns (McDonnell-Douglas Res. Labs.) [1972] 45 p refs
(Grant NGR-26-008-001)
(NASA-CR-130921) Avail: NTIS HC $4.25 CSCL 03B

During three balloon flights of a 1 sq m sr ionization chamber/Cerenkov counter detector system, measurements were made of the atmospheric attenuation, flux, and charge composition of cosmic ray nuclei with 16 is less than or = Z is less than or = 30 and rigidity greater than 4.5 GV. The attenuation mean free path in air of VH (20 less than or = Z less than or = 30) nuclei is found to be 19.7 + or - 1.6 g/sq cm, a value somewhat greater than the best previous measurement. The attenuation mean free path of iron is found to be 15.6 + or - 2.2 g/sq cm, consistent with predictions of geometric cross-section formulae. An absolute flux of VH nuclei 10 to 20% higher than earlier experiments at similar geomagnetic cutoff and level of solar activity was measured. The relative abundances of even-charged nuclei are found to be in good agreement with results of other recent high resolution counter experiments. The observed cosmic ray chemical composition implies relative abundances at the cosmic ray source of Ca/Fe = 0.12 + or - 0.04 and S/Fe = 0.14 + or - 0.05. Author

N73-18812# Institut d'Aeronomie Spatiale de Belgique, Brussels.
ASYMPTOTIC BEHAVIOR OF THE SOLAR WIND KINETIC MODEL [COMPORTEMENTS ASYMPTOTIQUES D'UN MODELE CINETIQUE DU VENT SOLAIRE]
J. Lemaire 1972 33 p refs In FRENCH; ENGLISH summary
(Aeronomica-Acta-A-108) Avail: NTIS HC $3.75

In this solar wind model the Coulomb collisions with impact parameter smaller than the Debye length, were neglected beyond the baropause located at 6.6 solar radii. The radial distribution of the electric potential was calculated in order to satisfy the local and global quasi-neutrality conditions in the whole exospheric plasma. The asymptotic behavior for large radial distances as well as in the neighborhood of the baropause was calculated and discussed. It was deduced that the electric field distribution near the baropause does not influence the properties at 1AU. A simple relationship between the coronal temperature and solar wind velocity at large radial distances was found; the kinetic plasma pressure was found to decrease asymptotically to zero as r approaches infinity. The parallel and perpendicular temperatures of the protons satisfy the adiabatic approximation of Chew, Goldberger and Low in the most external region. Author

N73-18813*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD DISSIPATION IN D-SHEETS
L. F. Burlaga and J. D. Scudder Feb. 1973 25 p refs Submitted for publication
(NASA-TM-X-66187; X-692-72-488) Avail: NTIS HC $3.25 CSCL 03B

The effects of magnetic field annihilation at a tangential or rotational discontinuity in a resistive plasma are examined. The magnetic field intensity profile depends on (1) the field intensities far from the current sheet (+ and - infinity), (2) the angle between the two intensities, and (3) the electrical resistivity. For a tangential discontinuity, the theory predicts a depression in B, centered at the discontinuity, and it predicts a monotonic transition. The theory provides satisfactory fits to the magnetic field intensity and proton temperature profiles observed for two extremely broad D-sheets in the solar wind. Assuming a diffusion time < 10 days, one obtains effective resistivities > or approximately = 3 x 10 to the 12th power and 2 x 10 to the 13th power emu for the D-sheets. Either resistivity at directional discontinuities is much lower than 10 to the 12th power emu or annihilation does not always occur at discontinuities. Author

N73-18814*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE MEASUREMENTS OF THE CHARGE COMPOSITION OF SOLAR COSMIC RAYS IN THE 6 LESS THAN OR EQUAL TO Z LESS THAN OR EQUAL TO 26 INTERVAL
B. J. Teegarden, T. T. VonRosenvinge, and F. B. McDonald Jun. 1972 25 p refs Submitted for publication
(NASA-TM-X-65947; X-661-72-222) Avail: NTIS HC $3.25 CSCL 03B

The charge composition of solar cosmic rays were measured during two flares occurring in April and September 1971. The results were derived from a solid state dE/dx vs E telescope which was part of the cosmic ray experiment on the IMP 6 spacecraft. The data suggest that the helium to medium ratio may be varying from one flare to the next. The abundance ratios (normalized to oxygen) are compared with measurements of other investigators and significant disagreements are found. In particular, the data do not exhibit any systematic enhancement of heavy nuclei with respect to the spectroscopic abundances such as

previously reported. Finally, the results are compared with the spectroscopically determined coronal and photospheric values, and again several important differences between the two sets of data are found. Author

N73-18815*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC RAYS IN A RANDOM MAGNETIC FIELD: BREAKDOWN OF THE QUASILINEAR DERIVATION OF THE KINETIC EQUATION
Thomas B. Kaiser (Maryland Univ., College Park), Frank C. Jones, and Thomas J. Birmingham Jul. 1972 16 p refs Submitted for publication
(Grant NGL-21-002-033)
(NASA-TM-X-65949; X-641-72-232) Avail: NTIS HC $3.00 CSCL 03B

The problem of deriving a kinetic equation for the cosmic ray distribution function in a random magnetic field is considered. A model is adopted which is mathematically simple but which contains the essential physics. The perturbation expansion upon which the quasi-linear treatment is based is investigated. The existence of resonant particles causes the breakdown of the adiabatic approximation frequently used in this theory. Resonant particles cause a general secular growth of higher order terms in the expansion which invalidates the entire perturbative approach. Author

N73-18816*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
SHORT-DURATION SOLAR MICROWAVE BURSTS AND ASSOCIATED SOFT X-RAY EMISSION M.S. Thesis
Steven R. Spangler Dec. 1972 104 p refs
(Grant NGL-16-001-002; Contract N00014-68-A-0196-0003)
(NASA-CR-130859; U-of-Iowa-73-2) Avail: NTIS HC $7.25 CSCL 03B

Two hundred and fifty-nine short-duration microwave (15.4 GHz) bursts which occurred during the period of January 1968 to March 1970 were correlated with possible soft X-ray (2-12 A) flares occurring simultaneously. Sixty-six percent of the microwave bursts which were observed during periods of soft X-ray data coverage had associated soft X-ray flares. A study of an index of impulsiveness of the microwave flares failed to show a separation of the events into subclasses which could be attributed to distinctly different physical mechanisms. A weak (0.43) correlation was found between the intensities of the microwave and X-ray flares. A very weak (0.15) and statistically questionable correlation was found between the total energy released in these two energy ranges. Two models for the electron acceleration mechanism are discussed. Author

N73-18817# Arbeitsgemeinschaft fuer Weltraumforschung, Munich (West Germany).
SCIENTIFIC MISSION FOR A SPIN STABILIZED SMALL ASTRONOMICAL RESEARCH SATELLITE [WISSENSCHAFTLICHES MISSIONSKONZEPT FUER EINEN SPINNSTABILISIERTEN, KLEINEN ASTRONOMISCHEN FORSCHUNGSSATELLITEN]
F.-K. Schroeder, comp., J. Truemper (Tuebingen Univ.), V. Schoenfelder (Tuebingen Univ.), L. Schmieder (DFVLR, Oberpfaffenhofen, West Ger.), and W. Duffek (DFVLR, Oberpfaffenhofen, West Ger.) Oct. 1972 19 p In GERMAN
Avail: NTIS HC $3.00

The mission of an Aeros-type astronomical spin-stabilized satellite, and its X-ray and infrared radiation experiments are described. The scientific objective is the investigation of cosmic X-ray sources with high time resolution in the pointing mode and a survey of the background radiation of the sky in the infrared range. In order to carry out astronomical observations, the alignment of the measuring instruments is parallel to the spin axis. The X-ray experiment involves two proportional counters with slit collimators, and the IR telescope contains a Cassegrain mirror with rotating chopper or an off-axis mirror with vibrating chopper. ESRO

N73-18818# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
RAW DATA PROCESSING OF THE EXPERIMENTS EI 88 AND EI 93 ON BOARD THE AZUR SATELLITE [ROHDATENVERARBEITUNG DER EXPERIMENTE EI 88 UND EI 93 IM SATELLITEN AZUR]
B. Ebel Mar. 1972 117 p refs In GERMAN; ENGLISH summary
(MPI-PAE/Extraterr-76) Avail: NTIS HC $8.00

A description is given of the processing of raw data from the experiments EI 88, directional proton flux in the energy range from 1.5 to 104 MeV, and alpha particle flux in the energy range from 6 to 19 MeV, and EI 93, omnidirectional proton and electron flux, onboard the AZUR satellite. The processing is separate from the physical evaluation of the data. The problems involved and their solution are stressed. Sufficient information is provided for possible users of both raw data and analyzed data tapes. The programs used are briefly described. ESRO

N73-18819*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
GAMMA RAY EMISSION FROM THE REGION OF THE GALACTIC CENTER Cosmic Physics Report
G. H. Dahlbacka, P. S. Freier, and C. J. Waddington Sep. 1972 23 p refs Sponsored in part by NASA
(Contract N00014-67-A-0113-0021)
(NASA-CR-130863; AD-751033; Rept-161) Avail: NTIS HC $3.25 CSCL 03B

A combination nuclear emulsion-spark chamber gamma ray (E = 100 MeV) telescope was used to study the region of sky that includes the Galactic Center. 95% confidence upper limits on the flux from the reported sources G gamma 2 - 3 and Sgr gamma-1 were placed at 4.4 and 8.8 x 10 to the minus 5th power protons/sq cm-sec, and a similar limit on the emission from the Galactic Center as a point source (plus or minus .75 degrees) was placed at 3.3 x 10 to the minus 5th power protons/sq cm-sec. No enhanced emission was observed from the Galactc Plane (plus or minus 6 degrees) and an upper limit of 2 x 10 to the minus 4th power protons/sq cm-sec rad/ was obtained. Author (GRA)

N73-18820# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Space Physics Lab.
THE LATITUDE MOTION OF SUNSPOTS AND SOLAR MERIDIONAL CIRCULATIONS Physical Sciences Research Papers
Fred Ward 21 Aug. 1972 28 p refs
(AF Proj. 8608)
(AD-751268; AFCRL-72-0499; AFCRL-PSRP-507) Avail: NTIS CSCL 03/2

There are many theories of the large-scale circulation of the sun. Fundamental to many of these is a meridional cell which transports momentum between the pole and equator. Observational verification has devolved most often upon the analysis of the latitudinal drifts of sunspots. A comprehensive analysis of sunspot drifts shows some peculiar results. Two conclusions can be drawn from these results. First, sunspot data cannot be used to verify the existence of a mean meridional circulation on the sun. Second, the residual meridional drifts (averaged over time and longitude) are very much smaller than their day-to-day counterparts, lending support to the idea that the latter are the more fundamental to the large-scale solar circulation. Author (GRA)

N73-18821# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ACCESS OF SOLAR PROTONS TO THE EARTH'S POLAR CAPS Report for Jul. 1971 - May 1972
Joseph F. Fennell 29 Dec. 1972 40 p refs
(Contract F04701-72-C-0073)
(AD-753679; TR-0073(3260-20)-12; SAMSO-TR-72-305) Avail: NTIS CSCL 04/1

Energetic solar proton observations (Ep approximately = 300 keV) in the interplanetary medium by Explorer 33 and Explorer 35 and over the polar caps by Injun 5 during the period September 1968 - March 1970 have been examined in detail. The solar proton intensities observed over the polar regions were compared to the interplanetary intensities on an absolute basis. Author (GRA)

N73-18099* Scientific Translation Service, Santa Barbara, Calif.
THE RADIATION HAZARD DURING SPACE FLIGHTS
Ye. Ye. Kovalev, A. V. Kolomenskiy, L. N. Smirennyy, and V. M. Petrov *In its* Phys. and Radiobiol. Invest. on Artificial Earth Satellites Jan. 1973 p 1-23 refs (For availability see N73-18098 09-04)
CSCL 18F

N73-18101* Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATION OF SHIELDING FROM COSMIC RADIATION
V. Ye. Dubkin, Ye. Ye. Kovalev, S. S. Skvortsov, L. N. Smirennyy, and A. I. Vikhrov *In its* Phys. and Radiobiol. Invest. on Artificial Earth Satellites Jan. 1973 p 57-84 refs (For availability see N73-18098 09-04)
CSCL 18F

N73-18637 Joint Publications Research Service, Arlington, Va.
DISTRIBUTION OF SCATTERED SOLAR RADIATION WITH RESPECT TO SKY ZONES FOR DIFFERENT PARTS OF THE SPECTRUM IN THE ABSENCE OF CLOUDS
M. P. Garadzha, T. V. Yevnevich, and Ye. I. Nezval *In its* Meteorology and Hydrol. no. 11, Nov. 1972 19 Jan. 1973 p 61-70 refs (For availability see N73-18631 09-20)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-18822* Stanford Univ., Calif.
PROJECT CYCLOPS: A DESIGN STUDY OF A SYSTEM FOR DETECTING EXTRATERRESTRIAL INTELLIGENT LIFE
1972 253 p refs Sponsored by NASA
(NASA-CR-114445) Avail: NASA. Ames Res. Center, Moffett Field, Calif. Attn: John Billingham, Code 239-1 CSCL 03B

The requirements in hardware, manpower, time and funding to conduct a realistic effort aimed at detecting the existence of extraterrestrial intelligent life are examined. The methods used are limited to present or near term future state-of-the-art techniques. Subjects discussed include: (1) possible methods of contact, (2) communication by electromagnetic waves, (3) antenna array and system facilities, (4) antenna elements, (5) signal processing, (6) search strategy, and (7) radio and radar astronomy. Author

N73-18823*# California Univ., Santa Barbara. Dept. of Physics.
DETERMINATION OF PARAMETERS RELATED TO THE INTERIOR OF MERCURY
S. J. Peale Mar. 1972 18 p refs
(Grant NGR-05-010-062)
(NASA-CR-130981) Avail: NTIS HC $3.00 CSCL 03B

Bounds on (C-A)/C for Mercury as a function of the uncertainty in the value of the obliquity are determined. The high precision of 1 min of arc which is required for reasonable bounds on (C-A)/C cannot be obtained by either earth based observations or the television imagery of the Mariner 73 flyby. Among other methods discussed, one involving both landers and orbiters could determine unambiguously not only (C-A)/C but also (B-A)/C and C/sq MR. Author

N73-18824*# California Univ., Berkeley.
IDENTIFICATION OF THE X-RAY PULSAR IN HERCULES: A NEW OPTICAL PULSAR
Arthur Davidsen, J. Patrick Henry, John Middleditch, and Harding E. Smith [1972] 14 p refs
(Grant NGR-05-003-450)
(NASA-CR-130923) Avail: NTIS HC $3.00 CSCL 03A

A series of photographic, photoelectric, and spectroscopic observations beginning June 1, 1972 has led to the optical identification of Her X-1 (2U 1705 + 34), a pulsed X-ray source in an eclipsing binary system, with the thirteenth magnitude blue variable star HZ Herculis. The detection of optical pulses at the frequency of the X-ray pulsar on three nights makes the identification conclusive and establishes HZ Her as the second known optical pulsar. The strength of the optical pulses may be correlated with the orbital phase but is not obviously related to the high or low intensity states of the X-ray source. Author

N73-18825*# Pittsburgh Univ., Pa. Space Research Coordination Center.
STABILITY OF THE MARTIAN ATMOSPHERE
Michael B. McElroy (Harvard Univ., Cambridge) and Thomas M. Donahue Aug. 1972 18 p refs
(Grant NGR-39-011-002)
(NASA-CR-130799; SRCC-177) Avail: NTIS HC $3.00 CSCL 03B

A detailed chemical dynamic model is presented for a moist Martian atmosphere. Recombination of CO2 is catalyzed by trace amount of H2O. The abundances of CO and O2 should vary in response to changes in atmospheric H2O and atmospheric mixing. Author

N73-18826*# California Inst. of Tech., Pasadena.
DEVELOPMENT AND INVESTIGATION OF PARTICLE DETECTORS IN SUPPORT OF OUTER PLANET DEFINITION STUDIES Final Report, 1 Jul. 1971 - 30 Sep. 1972
Rochus E. Vogt 30 Sep. 1972 24 p
(Grant NGR-05-002-225)
(NASA-CR-130917) Avail: NTIS HC $3.25 CSCL 22A

Research is reported in support of the definition phase of the Outer Planets Missions. The definitions studies are discussed along with the investigations of the triple-grooved solid-state detectors. F.O.S.

N73-18827*# Boeing Co., Huntsville, Ala. Saturn/Apollo/Skylab Div.
SPACE TUG AEROBRAKING STUDY. VOLUME 2: TECHNICAL Final Report
Charles J. Corso and C. L. Eyer 12 Apr. 1972 519 p refs
(Contract NAS8-27501)
(NASA-CR-124057; D5-17142-Vol-2) Avail: NTIS HC $28.00 CSCL 22A

The feasibility and practicality of employing an aerobraking trajectory for return of the reusable Space Tug from geosynchronous and other high energy missions was investigated. The aerobraking return trajectory modes from high orbits employ transfer ellipses which have low perigee altitudes wherein the earth's sensible atmosphere provides drag to reduce the Tug descent delta velocity requirements and thus decrease the required return trip propulsive energy. An aerobraked Space Tug, sized to the Space Shuttle payload capability and dimensional constraints, can accomplish 95 percent of the geosynchronous missions with a single Shuttle/Tug launch per mission. Aerodynamics, aerothermodynamics, trajectory, guidance and control, configuration concepts, materials, weights and performance parameters were identified. Sensitivities to trajectory uncertainties, atmospheric anomalies and re-entry environments were determined. New technology requirements and future studies required to further enhance the aerobraking potential were identified. Author

N73-18828*# IIT Research Inst., Washington, D.C.
MISSION ANALYSES FOR MANNED FLIGHT EXPERIMENTS Final Report, 23 Jun. 1971 - 31 Dec. 1972
Joseph E. Orth 2 Jan. 1973 93 p refs
(Contract NASw-2259)
(NASA-CR-130989; IITRI-V6123-F) Avail: NTIS HC $6.75 CSCL 22C

The investigations to develop a high altitude aircraft program plan are reported along with an analysis of manned comet and asteroid missions, the development of shuttle sortie mission objectives, and an analysis of major management issues facing the shuttle sortie. Author

N73-18829*# Yale Univ., New Haven, Conn. Watson Astronomy Center.
[LOCAL THERMODYNAMIC EQUILIBRIUM IN STELLAR ATMOSPHERES] Final Technical Report
Rupert Wildt 10 Jan. 1973 4 p
(Grant NGR-07-004-004)

(NASA-CR-130792) Avail: NTIS HC$3.00 CSCL 03B

Investigations of deviations in local thermodynamic equilibrium in stellar atmospheres are summarized. Included are studies in gray and AO star atmospheres. F.O.S.

N73-18830*# Colorado Univ., Denver. Lab. for Atmospheric and Space Physics.

PHOTOPOLARIMETRY TEAM OUTER PLANETS MISSION DEFINITION PHASE Final Report, 1 Aug. 1971 - 31 Aug. 1972

31 Aug. 1972 51 p refs

(Grant NGR-06-003-184)

(NASA-CR-130977) Avail: NTIS HC $4.75 CSCL 03A

The work is reported of the Photopolarimetry Team in identifying scientific objectives for photometer/polarimeter experiments for outer planet flyby missions. A discussion of the scientific objectives which can be attained with a photometer/polarimeter experiment, and summaries of the special studies which were performed for the Photopolarimetry Team are presented along with a description of the photometer/polarimeter design which was developed for the Meteoroid Detection Team. F.O.S

N73-18831*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Guidance and Flight Mechanics Dept.

PERFORMANCE ANALYSIS AND DESIGN SYNTHESIS (PADS) COMPUTER PROGRAM. VOLUME 2: PROGRAM DESCRIPTION, PART 1 Final Report

Nov. 1972 760 p refs

(Contract NAS9-12059)

(NASA-CR-128678; MDC-G4287-Vol-2-Pt-1) Avail: NTIS HC $40.00 CSCL 22A

The Performance Analysis and Design Synthesis (PADS) computer program has a two-fold purpose. It can size launch vehicles in conjunction with calculus-of-variations optimal trajectories and can also be used as a general-purpose branched trajectory optimization program. In the former use, it has the Space Shuttle Synthesis Program as well as a simplified stage weight module for optimally sizing manned recoverable launch vehicles. For trajectory optimization alone or with sizing, PADS has two trajectory modules. The first trajectory module uses the method of steepest descent; the second employs the method of quasilinearization, which requires a starting solution from the first trajectory module. For Volume 1 see N73-13199. Author

N73-18832*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Guidance and Flight Mechanics Dept.

PERFORMANCE ANALYSIS AND DESIGN SYNTHESIS (PADS) COMPUTER PROGRAM. VOLUME 2: PROGRAM DESCRIPTION, PART 2 Final Report

Nov. 1972 889 p

(Contract NAS9-12059)

(NASA-CR-128657; MDC-G4287-Vol-2-Pt-2) Avail: NTIS HC $46.50 CSCL 22A

The QL module of the Performance Analysis and Design Synthesis (PADS) computer program is described. Execution of this module is initiated when and if subroutine PADSI calls subroutine GROPE. Subroutine GROPE controls the high level logical flow of the QL module. The purpose of the module is to determine a trajectory that satisfies the necessary variational conditions for optimal performance. The module achieves this by solving a nonlinear multi-point boundary value problem. The numerical method employed is described. It is an iterative technique that converges quadratically when it does converge. The three basic steps of the module are: (1) initialization, (2) iteration, and (3) culmination. For Volume 1 see N73-13199. Author

N73-18833*# Translation Consultants, Ltd., Arlington, Va.

ASTRONOMY AND ASTROPHYSICS, NO. 14: PHYSICS OF THE MOON AND PLANETS

I. K. Koval, ed. Washington NASA Feb. 1973 97 p refs Transl. into ENGLISH of the publ. "Astrometriya i Astrofiza 14: Fizika Luny i Planet" Kiev, Naukova Dumka, 1971 69 p

(Contract NASw-2038)

(NASA-TT-F-747) Avail: NTIS HC $3.00 CSCL 03B

The results of spectrometry investigations of the planets are presented. The data are based on observations made by USSR astronomical observatories. Much of the material is devoted to the study of ultraviolet absorption in the continuous spectrum of different sections of Jupiter and Saturn. Results of photometric measurements of artificial planets crested in USSR laboratories are included. For individual titles, see N73-18834 through N73-18840.

N73-18834* Translation Consultants, Ltd., Arlington, Va.

THE VIOLET CLOUDS OF MARS

N. B. Ibragimov and I. K. Koval *In its* Astronomy and Astrophys., No. 14: Phys. of the Moon and Planets Feb. 1973 p 3-9 refs (For availability see N73-18833 09-30)

CSCL 03B

Photometric investigations of Martian violet clouds based on observations carried out during 1958 - 1961, 1965, and 1969 are discussed. Monochromatic albedo was determined for an intense cloud observed near the terminator in the southern hemisphere on April 24, 1969. The values of optical thickness found in this investigation permitted the Junge parameter to be determined and a conclusion to be made that the violet cloud consists mainly of small particles. Author

N73-18835* Translation Consultants, Ltd., Arlington, Va.

ULTRAVIOLET ABSORPTION IN THE CONTINUOUS SPECTRUM OF JUPITER

V. D. Krugov *In its* Astronomy and Astrophys., No. 14: Phys. of the Moon and Planets Feb. 1973 p 10-28 refs (For availability see N73-18833 09-30)

CSCL 03B

Spectrophotometric investigation of Jupiter for the purpose of determining ultraviolet absorption for different regions of Jupiter's disk region are presented. About 100 spectrograms were taken during 1969 (January - April). It is shown that ultraviolet absorption in Jupiter's atmosphere is real and the quantity of effect for positions of the spectrograph's vision slit equals minus 0.33. Time variations are observed in the course of reflectivity for different regions of Jupiter's disk. The quantity of ultraviolet absorption is approximately the same for Jupiter's northern and southern polar regions. Author

N73-18836* Translation Consultants, Ltd., Arlington, Va.

DISTRIBUTION OF THE ENERGY IN THE SHORTWAVE REGION OF THE SPECTRUM FOR VARIOUS PARTS OF SATURN'S DISK

V. D. Krugov *In its* Astronomy and Astrophys., No. 14: Phys. of the Moon and Planets Feb. 1973 p 29-41 refs (For availability see N73-18833 09-30)

CSCL 03B

The results are presented of measuring ultraviolet absorption for Saturn's disk in a range of 3300 - 4800 taken in 1968 - 1969. It is found out that the quantity of ultraviolet absorption for various regions of Saturn's disk (equator, meridian, the southern polar region, eastern and western limbs) is 0.30 on the average. Time variations are observed in the course of reflectivity for various regions of Saturn's disk. The data for the rings show a more neutral motion of albedo along the spectrum, and time variations are shown rather less. Author

N73-18837* Translation Consultants, Ltd., Arlington, Va.

RESULTS OF LABORATORY PHOTOMETRIC MEASUREMENTS OF ARTIFICIAL PLANETS

O. I. Bugayenko, I. K. Koval, V. D. Krugov, A. V. Morozhenko, and L. F. Slutskiy *In its* Astronomy and Astrophys., No. 14: Phys. of the Moon and Planets Feb. 1973 p 42-60 refs (For availability see N73-18833 09-30)

CSCL 03B

Results are given of photoelectric measurements of brightness distribution and brightness-phase dependence for six spheres whose surfaces have different colors and roughness. These results are applied to verify validity of some empirical formulas used earlier for determining optical parameters of the Martian surface. Author

N73-18838* Translation Consultants, Ltd., Arlington, Va.

SPECTROPHOTOMETRIC PECULIARITIES OF SOME SATELLITES OF PLANETS

Yu. D. Davudov and I. K. Koval *In its* Astronomy and Astrophys., No. 14: Phys. of the Moon and Planets Feb. 1973 p 61-69

refs (For availability see N73-18833 09-30)
CSCL 03B

Stebbin's and Jacobsen's photoelectric measurements of the solar phase-brightness relationship for Jupiter's Galilean satellites are used to show that the surface layers of the satellites are very porous. The parameter that characterized relative density of a surface layer is equal to 0.2 for Callisto. Results of spectrophotometric observations of satellites are discussed briefly from the point of view of the possible nature of their surfaces.
Author

N73-18839* Translation Consultants, Ltd., Arlington, Va.
GLOW FROM THE LIMB SIDE OF A SPHERICAL PLANETARY ATMOSPHERE
E. G. Yanovitskiy *In its* Astronomy and Astrophys., No. 14: Phys. of the Moon and Planets Feb. 1973 p 70-80 refs (For availability see N73-18833 09-30)
CSCL 03B

An approximate formula is derived for calculating the diffuse radiation from the limb side of a spherical planetary atmosphere. The case of an atmosphere adjoining a surface that reflects light isotropically is considered. For the case of very small optical thickness of the atmosphere a simple analytical expression is found for computation of diffuse radiation intensity in the assumption that scattering coefficient of the aerosol and gas atmospheric components changes exponentially with altitude. This formula is used for calculation of the limbside radiation intensity of the Martian atmosphere.
Author

N73-18840* Translation Consultants, Ltd., Arlington, Va.
THE POSSIBILITY OF AUTOMATICALLY OBTAINING STATISTICAL MORPHOLOGICAL CHARACTERISTICS OF SECTIONS OF THE LUNAR SURFACE FROM THEIR PHOTOGRAPHIC IMAGES
L. A. Akimov and Yu. K. Korniyenko *In its* Astronomy and Astrophys., No. 14: Phys. of the Moon and Planets Feb. 1973 p 81-93 refs (For availability see N73-18833 09-30)
CSCL 03B

The possibility of automatically obtaining statistical morphological characteristics of portions of the lunar surface from photographic imagery is discussed. Practical ways of realizing the possiblity are examined. Obtaining some statistical morphological characteristics of a region by analogy methods using a coherent light beam technique is described. It is shown that this method is also applicable to planets.
Author

N73-18841*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MARINER 9 PHOTOGRAPHS OF SMALL-SCALE VOLCANIC STRUCTURES ON MARS
Ronald Greeley Dec. 1972 22 p refs Prepared in cooperation with Santa Clara Univ., Calif.
(NASA-TM-X-62222) Avail: NTIS HC $3.25 CSCL 03B

Surface features on the flanks of Martian shield volcanoes photographed by Mariner 9 are identified as lava flow channels, rift zones, and partly collapsed lava tubes by comparisons with similar structures on the flanks of Mauna Loa shield volcano, Hawaii. From these identifications, the composition of the Martian lava flows is interpreted to be basaltic, with viscosities ranging from those of fluid pahoehoe to more viscous aa.
Author

N73-18842*# Martin Marietta Corp., Denver, Colo.
ASTRONOMY SORTIE MISSIONS DEFINITION STUDY. VOLUME 2, BOOK 1: ASTRONOMY SORTIE PROGRAM TECHNICAL REPORT Final Report
Sep. 1972 167 p refs Prepared in cooperation with Itek Corp., Lexington, Mass. and Bendix Corp., Denver, Colo.
(Contract NAS8-28144)
(NASA-CR-124043; AM-1002-1004-Vol-2-Bk-1) Avail: NTIS HC $10.50 CSCL 03A

The work performed to arrive at a baseline astronomy sortie mission concept is summarized. The material includes: (1) definition of the telescopes and arrays; (2) preliminary definition of mission and systems; (3) identification, definition, and evaluation of alternative sortie programs; (4) the recommended astronomy sortie program; and (5) the astronomy sortie program concept that was approved as a baseline for the remainder of the project.
Author

N73-18843*# Martin Marietta Corp., Denver, Colo.
ASTRONOMY SORTIE MISSIONS DEFINITION STUDY. VOLUME 2, BOOK 2: APPENDIX Final Report
Sep. 1972 356 p refs Prepared in cooperation with Bendix Corp., Denver and Itek Corp., Lexington, Mass.
(Contract NAS8-28144)
(NASA-CR-124045; AM-1002-1004-Vol-2-Bk-2-App) Avail: NTIS HC $20.00 CSCL 03A

An updated and coordinated baseline experiment definition document is presented for each of the candidate astronomy sortie mission telescopes and arrays. The experiment objectives, requirements, interfaces, timelines, and programmatic considerations are included.
D.L.G.

N73-18844# Technischen Universitaet, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
SERIES EXPANSIONS WITH RESPECT TO EIGENFUNCTIONS AND THEIR APPLICATION PROBLEMS OF ORBITAL MECHANICS
M. Schneider Dec. 1972 33 p refs Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-33) Avail: NTIS HC $3.75; ZLDI Munich: 7 DM

The expansion of various functions by using eigenfunctions originating from boundary value problems is discussed. Several applications to initial value and boundary value problems of orbital mechanics are shown.
Author

N73-18845# Chalmers Univ. of Technology, Goteborg (Sweden).
SEARCHES FOR INTERSTELLAR MOLECULES AND STUDIES OF RECOMBINATION LINES FROM THE DIFFUSE MATTER IN THE GALAXY
B. Torgny Cato 1972 90 p refs
(RR-108) Avail: NTIS HC $6.50 CSCL 03B

Molecular spectroscopic studies in radio astronomy are reported. The rotational transition frequencies for formic acid, formamide, and acetaldehyde in the microwave range are discussed and a search for interstellar formic acid in the 1.2 MHz range led to negative results. The characteristics of the emission lines from interstellar OH molecules are reviewed and searches with the 25.6 radio telescope equipped with travelling wave maser radiometers for OH, CH, SO2, HCN, H2CS, NH2CHO, and CH3CHO also proved negative with the possible exception of H2CS. The adsorption and emission of radio recombination lines and ionization of the diffuse interstellar matter are considered. Observations of the H 157 alpha recombination line (1683.2 MHz), from regions of the galactic plane free of discrete radio sources, show the line radiation to come from a region spatially coincident with giant H II regions.
N.E.N.

N73-18846# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
IMPACT SAFETY IN ELECTRE LAUNCHINGS
Marcel Bismut 1972 22 p In FRENCH; ENGLISH summary Presented at the Colloq. Intern. sur les Bases de Lancement, Kourou, France, 22-28 Nov. 1972
(ONERA-TP-1152) Avail: NTIS HC $3.25

To observe the reentry of Electre nose cones, launched at the Landes Test Centre (along the coast of southwest France) by Tibere rockets, it was necessary to plan a trajectory as near the coast as possible. Particular attention was then paid to the problem of safeguarding the local inhabitants, and an optimal intervention policy was applied. This policy was defined by minimizing costs by a linear combination of the risk of impact in an inhabited zone, i.e. the mathematical expectation of the population density at the impact points of the various stages, and of the potential loss inflicted on the experimenter, i.e. the probability of rocket destruction. A rule of launch interdiction as a function of the wind observed by sounding, a safety corridor monitored in real time, and a criterion for target changing at end of climb were thus defined. The system worked normally during the two Electre experiments and one Belier 3 launching.
Author

N73-18847*# Translation Consultants, Ltd., Arlington, Va.
RADAR STUDIES OF THE MOON
N. N. Krupenio Washington NASA Feb. 1973 202 p refs Transl. into ENGLISH of the book "Radiolokatsionnyye Is-

sledovaniya Luny" Moscow, Nauka Press, 1971
(Contract NASw-2038)
(NASA-TT-F-729) Avail: NTIS HC $3.00 CSCL 03B

Radar methods of investigating the moon and planets by ground radar and radio equipment installed in space vehicles are reviewed. The terminology of the characteristics of reradiation from the surface layer of the moon and planets in the radio spectrum, the interconnection between them, the principal characteristics of reradiation necessary to calculate the energy parameters for the radio-frequency circuits for different locations of transmitters, illuminated surface, and receiver, and the results of radar observations of the moon from the earth, and from space vehicles, over a broad band of radio waves, are presented. Author

N73-18848# Joint Publications Research Service, Arlington, Va.
CONICAL SECTION METHOD FOR DETERMINING THE GEOMETRIC CONFIGURATION OF A PLANET BY PHOTOGRAPHS TAKEN FROM SPACE
Yu. G. Karpushin, S. V. Lebedev, and Yu. M. Neyman 23 Feb. 1973 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Geod. i Aerofotos'emka (Moscow), no. 3, 1972 p 53-60
(JPRS-58304) Avail: NTIS HC $3.00

A procedure is given for determining the geometric configuration of a planet in the form of a mathematically convenient closed surface approximating the real physical surface of the planet under a defined condition. Author

N73-18849*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
MEASUREMENTS OF INFRARED RADIATION FROM MERCURY AND THE MOON Ph.D. Thesis
Thomas Lee Murdock Dec. 1972 116 p refs
(Grant NGL-24-005-008; Contract N00014-67-A-0113-0004)
(NASA-CR-130968; Rept-13; AD-751673) Avail: NTIS HC $8.00 CSCL 03B

Studies of the 2.3 to 18 micron infrared radiation from the planet Mercury and the 2.3 to 8.6 micron infrared radiation from the Moon are presented in this thesis. Experimental results are compared with predictions based on a smooth spherical black body model and it is found that neither object radiates like the model and, although they are not identical, Mercury and the Moon are quite similar. Author (GRA)

N73-18850*# Minnesota Univ., Minneapolis.
PROPER MOTION SURVEY WITH THE FORTY-EIGHT INCH SCHMIDT TELESCOPE. 33: PROPER MOTIONS FOR 3478 FAINT STARS
Willem J. Luyten 1 Nov. 1972 33 p
(Contract NSR-24-005-245; Grant NSF GP-23509)
Avail: NTIS HC $3.75 CSCL 03A

Data for the motions of 3478 stars are presented. The data were obtained with the automated-computerized plate scanner and measuring machine. Only data for those stars for which no earlier determination of proper motions have been made are included. Author

N73-18851# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 294
13 Feb. 1973 60 p refs Transl. into ENGLISH from various Soviet Bloc periodicals
(JPRS-58218) Avail: NTIS HC $5.00

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Author

N73-18852# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 295
27 Feb. 1973 79 p refs Transl. into ENGLISH from various Soviet Bloc periodicals
(JPRS-58333) Avail: NTIS HC $6.00

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy, and terrestrial geophysics, covering both science news and formal scientific reports. Author

N73-18853# Arbeitsgemeinschaft fuer Weltraumforschung, Munich (West Germany).
THE SCIENTIFIC MISSION OF HELIOS A AND B [DIE WISSENSCHAFTLICHE AUFGABENSTELLUNG VON HELIOS A UND B]
Herbert Porsche 1972 15 p In GERMAN Presented at the 5th DGLR Ann. Meeting, Berlin, 4-6 Oct. 1972
(DGLR-Paper-72-068) Avail: NTIS HC $3.00

Experiments to be flown onboard the Helios A and Helios B interplanetary probes are described. This project for the investigation of the influence of the sun in interplanetary space includes five experiments on the low energy solar plasma, three on high energy particles and two on interplanetary dust. The scientific aspects of these experiments are discussed. ESRO

N73-18854# European Space Research and Technology Center, Noordwijk (Netherlands).
FEATURES OF THE MAGNETIC ALIGNMENT OF THE ESRO 1 SATELLITE
R. Aiguabella Aug. 1972 44 p refs
(ESRO-SN-120-ESTEC) Avail: NTIS HC $4.25

The attitude stability of the magnetically oriented satellite ESRO-1A (Aurorae) during the period of October 10 to December 7, 1968 was investigated. Large disturbances appeared, during which the alignment of the spacecraft with the geomagnetic field vector failed to remain within the nominal limits. This occurred in about 50% of the orbits analyzed, which were distributed reasonably uniformly throughout the period. The perturbation time was much greater than the orbital period, and the modulation effects due to the varying intensity or direction of the field during the course of a single orbit are shown to be minor. No evidence was found to suggest that the misalignment pattern observed can be attributed to the effects of drag in the upper atmosphere following severe geomagnetic storms. Extensive and systematic correlation with geomagnetic activity, basically measured in terms of the K sub P index, revealed that variations in average misalignment data correlate well with the corresponding variations in K sub P provided the time-scale they are referred to is sufficiently large. Author (ESRO)

N73-18855# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE RELATIVE ORIENTATION OF THE COORDINATE SYSTEMS OF FUNDAMENTAL CATALOGS
N. T. Mironov 20 Sep. 1972 13 p refs Transl. into ENGLISH from Izv. Gl. Astron. Observ. Pulkovo (USSR), no. 13, 1971 p 13-18
(AD-751077; FTD-HT-23-1357-72) Avail: NTIS CSCL 03/1

In the literature on astronomy there are often indications that each fundamental catalog defines its own coordinate system in space. In other words, the equators and points of the vernal equinox for the various catalogs do not coincide. The authors propose a method for determining the relative orientation of the coordinate axes of stellar catalogs. GRA

N73-18856# Owens Valley Radio Observatory, Pasadena, Calif.
OBSERVATIONS OF THE NEUTRAL HYDROGEN ABSORPTION SPECTRUM OF CYGNUS X-3
K. W. Chu and J. H. Bieging 1972 12 p refs
(Contract N00014-67-A-0094-0019; Grant NSF GP-30400)
(AD-752497; Rept-1972-12) Avail: NTIS CSCL 03/2

The authors have made interferometric observations of the neutral hydrogen absorption spectrum of Cygnus X-3. The radio source is more than 10.4 kpc from the sun, and the columnar density of netural hydrogen along the line of sight is at least 1.7 x 10 to the 20th power (T sub s)/sq cm. Author (GRA)

N73-18857# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMAL PLOTTING OF AN ELLIPTICAL TRANSFER ORBIT EMPLOYING COMPLETE REVOLUTIONS IN THE EQUATORIAL PLANE OF AN AXISYMMETRIC PLANET
V. S. Novoselov 8 Dec. 1972 29 p refs Transl. into ENGLISH from Tr. Astron. Observ. (Leningrad), v. 26, no. 44, 1969

p 97-113
(AD-753517; FTD-MT-24-1486-72) Avail: NTIS CSCL 22/3

The problem of construction of an elliptical orbit of transition between two orbits with small eccentricities with random and given phases of identical direction motions in the equatorial plane of an axisymmetrical planet is solved. The transition may contain some number of free orbits around the planet and is realized by means of changes of velocity on the initial and final orbits. The problem is solved by the method of approximate solution of variational problems. With accuracy to a small parameter, the transition osculatory ellipse is selected, which minimizes the consumption of fuel for maneuvering. It is assumed that maneuvering is restricted. Equations are derived which allow determination of the optimal orbit of transition. Author (GRA)

N73-18884* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE APOLLO 14 DOCKING ANOMALY
Robert D. Langley *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 191-201 (For availability see N73-18866 09-31)
CSCL 22C

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-18858*# Chrysler Corp., New Orleans, La. Space Div.
SINGLE STAGE EARTH ORBITAL REUSABLE VEHICLE. VOLUME 6: RESOURCES Final Report
30 Jun. 1971 235 p
(Contract NAS8-26341)
(NASA-CR-124091; TR-AP-71-4-Vol-6) Avail: NTIS HC $3.75 CSCL 22B

The results of a conceptual study of the resource requirements for a single-stage earth-orbital vehicle are presented. All aspects of program costs for the design, manufacture, test, transportation, launch, and facility modifications were considered. The following program costs are discussed: configuration definition, cost groundrules and assumptions, program requirements, work breakdown structure, cost estimation methods, and cost analysis. High cost areas are identified. F.O.S.

N73-18859*# Auburn Univ., Ala. Guidance and Control Study Group.
MULTIVARIABLE CONTROL THEORY APPLIED TO HIERARCHICAL ATTITUDE CONTROL FOR PLANETARY SPACECRAFT
J. S. Boland, III and D. W. Russell 8 Dec. 1972 73 p refs
(Contract NAS8-27827)
(NASA-CR-124087) Avail: NTIS HC $5.75 CSCL 22B

Multivariable control theory is applied to the design of a hierachical attitude control system for the CARD space vehicle. The system selected uses reaction control jets (RCJ) and control moment gyros (CMG). The RCJ system uses linear signal mixing and a no-fire region similar to that used on the Skylab program; the y-axis and z-axis systems which are coupled use a sum and difference feedback scheme. The CMG system uses the optimum steering law and the same feedback signals as the RCJ system. When both systems are active the design is such that the torques from each system are never in opposition. A state-space analysis was made of the CMG system to determine the general structure of the input matrices (steering law) and feedback matrices that will decouple the axes. It is shown that the optimum steering law and proportional-plus-rate feedback are special cases. A derivation of the disturbing torques on the space vehicle due to the motion of the on-board television camera is presented. A procedure for computing an upper bound on these torques (given the system parameters) is included. Author

N73-18860*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CONTROL SYSTEM OPTIMIZATION STUDIES. VOLUME 1: PAYLOAD DEPLOYMENT STUDY Final Report, 1 Jul. 1971 - 6 Mar. 1972
G. M. Heeschen and A. M. Hansing Mar. 1972 82 p refs
(Contract NAS8-30515)
(NASA-CR-124050; HREC-0515-6-Vol-1; LMSC/HREC-D225642-1-Vol-1) Avail: NTIS HC $6.25 CSCL 22B

An analysis of the critical parameters involved in designing systems for spacecraft maneuvers involved in stationkeeping, docking, orbital assembly, satellite inspection and retrieval, and payload deployment is presented. The fixed base simulation was performed on a hybrid computer and includes a cathode ray tube display so that the maneuvers can be visually monitored by a pilot located in the active vehicle. Both automatic and manual control modes are included and the pilot can switch between the two modes as desired. A complete description of the hybrid simulation is provided and simulation results are described. Major digital subroutines, flow charts, and analog wiring diagrams are provided. Author

N73-18861*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CONTROL SYSTEM OPTIMIZATION STUDIES. VOLUME 2: HIGH FREQUENCY CUTOFF FILTER ANALYSIS Final Report, 1 Jul. 1971 - 6 Mar. 1972
M. H. Fong Mar. 1972 100 p refs
(Contract NAS8-30515)
(NASA-CR-124051; HREC-0515-6-Vol-2; LMSC/HREC-D225642-2-Vol-2) Avail: NTIS HC $7.00 CSCL 22B

The problem of digital implementation of a cutoff filter is approached with consideration to word length, sampling rate, accuracy requirements, computing time and hardware restrictions. Computing time and hardware requirements for four possible programming forms for the linear portions of the filter are determined. Upper bounds for the steady state system output error due to quantization for digital control systems containing a digital network programmed both in the direct form and in the canonical form are derived. This is accomplished by defining a set of error equations in the z domain and then applying the final value theorem to the solution. Quantization error was found to depend upon the digital word length, sampling rate, and system time constants. The error bound developed may be used to estimate the digital word length and sampling rate required to achieve a given system specification. From the quantization error accumulation, computing time and hardware point of view, and the fact that complex poles and zeros must be realized, the canonical form of programming seems preferable. Author

N73-18862*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
SUMMARY OF RESULTS OF PARAMETRIC STUDIES OF SPACE SHUTTLE BOOSTER, ORBITER, AND LAUNCH VEHICLE CONCEPTS Final Summary Report
Dale Bradley and Robert E. Buchholz 31 Dec. 1972 168 p refs
(Contract NAS8-26370)
(NASA-CR-124090; LMSC/HREC-D306346; HREC-6370-2) Avail: NTIS HC $10.50 CSCL 22B

The results of analytical and experimental parametric studies of space shuttle booster, orbiter and launch vehicle aerodynamics are described. During this study over 1700 hours of experimental wind tunnel tests were conducted on several versions of the shuttle booster, orbiter and launch vehicle. Fifteen separate tests were conducted in three different test facilities. Due to the number of test programs conducted and the time required for test preparation, analysis of the test data has been limited to that required to drive the experimental program. A brief description of each of the experimental tests conducted including the test purpose and approach is included. Several test models were designed and fabricated in support of the experimental program. These models are described. Author

N73-18863*# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
ITOS D AND E SYSTEM DESIGN REPORT, VOLUME 1
30 Apr. 1970 342 p
(Contract NAS5-10306)

(NASA-CR-130160; AED-R-3553F-Vol-1) Avail: NTIS HC $19.25 CSCL 22B

The configuration and functions of the ITOS D and E system are described. The system will expand the operational capability of the basic TIROS M/ITOS system. The ITOS D and E mission will utilize the capabilities of the two-stage DSV 3N-6 Delta launch vehicle to place the ITOS D and E spacecraft into a circular, near-polar, sun synchronous orbit at 790 nautical miles altitude. The ITOS D and E will provide the following primary data: (1) visible daytime observations of cloud cover, (2) daytime and nighttime observations of cloud cover as detected from radiance in infrared spectrum, and (3) vertical temperature profile of the atmosphere on a global basis for data processing. In addition, the ITOS D and E system will provide secondary data comprising solar proton density measurements obtained throughout the orbit. Author

N73-18864*# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
ITOS D AND E SYSTEM DESIGN REPORT, VOLUME 2
30 Apr. 1970 301 p
(Contract NAS5-10306)
(NASA-CR-130161; AED-R-3553F-Vol-2) Avail: NTIS HC $17.25 CSCL 22B

For abstract, see N73-18863.

N73-18865*# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
ITOS D AND E SYSTEM DESIGN REPORT, VOLUME 3
30 Apr. 1970 144 p refs
(Contract NAS5-10306)
(NASA-CR-130162; AED-R-3553F-Vol-3) Avail: NTIS HC $9.25 CSCL 22B

For abstract, see N73-18863.

N73-18866*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE 7TH AEROSPACE MECHANISMS SYMPOSIUM
George G. Herzl, ed. Nov. 1972 307 p refs Conf. held at Houston, Tex., 7-8 Sep. 1972; sponsored in part by Calif. Inst. of Tech., and Lockheed Missiles and Space Co., Inc.
(NASA-TM-X-58106; MSC-07219) Avail: NTIS HC $17.50 CSCL 22B

Papers are presented covering the more significant operational mechanisms problems and experiences from the Apollo program. The unique mechanism subjects for future programs, such as the Apollo Soyuz Test Project, the space shuttle, and other related activities, are also considered. For individual titles, see N73-18867 through N73-18891.

N73-18867* Lockheed Missiles and Space Co., Sunnyvale, Calif.
MECHANISM PROBLEMS
John K. Riedel *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 3-13 ref (For availability see N73-18866 09-31)
CSCL 22B

It is pointed out that too frequently during the design and development of mechanisms, problems occur that could have been avoided if the right question had been asked before, rather than after, the fact. Several typical problems, drawn from actual experience, are discussed and analyzed. The lessons learned are used to generate various suggestions for minimizing mistakes in mechanism design. Author

N73-18868* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE APOLLO 15 DEPLOYABLE BOOM ANOMALY
Robert D. White *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 15-26 (For availability see N73-18866 09-31)
CSCL 22B

During the Apollo 15 mission, a boom with an attached mass spectrometer was required to retract periodically so that the instrument would not be in the field of view of other experiments. The boom did not fully retract on five of 12 occasions. Data analysis indicated that the boom probably retracted to within approximately 2.54 centimeters (1 inch) of full retraction. The pertinent boom-design details, the events in the mission related to the anomaly, a discussion of the inflight and postflight investigation of the problem, a discussion of the design changes to the boom mechanism as a result of the investigation, and subsequent flight performance are presented. Author

N73-18869* Academy of Sciences (USSR), Moscow.
DOCKING SYSTEM OF ANDROGYNOUS AND PERIPHERAL TYPE
V. S. Syromyatnikov *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 27-35 refs (For availability see N73-18866 09-31)
CSCL 22B

Soviet and American space engineers have proceeded with creating compatible means for closing and docking spacecraft. It was decided to make a new advanced docking system of a peripheral and androgynous type. Because of a more complex design of the new-type docking mechanism, a number of technical problems arose. To a great extent, the solution of these problems depends on a chosen concept of the docking mechanism. The report deals with the docking system concept accepted by the Soviet engineers as the basis for further development. The description and structural arrangement of the docking system as a whole, its basic assemblies, and a kinematic scheme of the docking mechanism using a system of differentials are given. It should be noted that the experience that was gained from the development of previous docking systems was used to create a new type of docking system. The main problems to be solved in the course of designing and developing the advanced system are noted. Author

N73-18870* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FOLDABLE 4.27 METER (14 FOOT) SPACECRAFT ANTENNA c09
Donald J. Starkey *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 37-46 (For availability see N73-18866 09-31)
CSCL 09E

The problems and solutions associated with the design, fabrication, and testing of a large, lightweight, radial-rib, folding, spacecraft antenna reflector are discussed. The antenna reflector was designed as a highly efficient communications system for outer-planet missions extending as far as approximately 59.839 x 10 to the 11th power meters (40 astronomical units) from the sun. The methods used to obtain a lightweight precision rib surface, the evaluation and fabrication of the metallic reflector mesh surface, and the surface-evaluation techniques used on the assembled antenna reflector are included. Author

N73-18871* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DYNAMIC ANALYSIS OF APOLLO-SALYUT/SOYUZ DOCKING
John A. Schliesing *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 47-57 (For availability see N73-18866 09-31)
CSCL 22B

The use of a docking-system computer program in analyzing the dynamic environment produced by two impacting spacecraft and the attitude control systems is discussed. Performance studies were conducted to determine the mechanism load and capture sensitivity to parametric changes in the initial impact conditions. As indicated by the studies, capture latching is most sensitive to vehicle angular-alinement errors and is least sensitive to lateral-miss error. As proved by load-sensitivity studies, peak loads acting on the Apollo spacecraft are considerably lower than the Apollo design-limit loads. Author

N73-18872* Hughes Aircraft Co., Culver City, Calif.
MECHANICAL COMPONENT SCREENING FOR SCANNER c14
J. L. Olson and W. J. Quinn *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 59-67 (For availability see N73-18866 09-31)
CSCL 20F

The critical mechanical components of the scan mirror mechanism are described and their evaluation and screening procedures are discussed. A bumper/damper unit is used in the design to reverse motion of the mirror and effect scan and retrace cycles. A wear evaluation was conducted on the bumper

impact surfaces that established nylon 6-10 as an acceptable material. The elastomeric dampers were subjected to thermal vacuum tests for condensables and outgassing as well as parametric life tests. The flexure pivots that support the mirror were tested to establish a curve of stress plotted as a function of cycles to failure for rotational operation. The pivots met the life requirement of 150,000,000 cycles at a + or - 2.9 deg amplitude during fatigue testing. Screening procedures were established for dampers and flexure pivots to obtain flight quality components. Author

N73-18873* Little (Arthur D.), Inc., Cambridge, Mass.
RADIATIVE COOLER FOR SPACECRAFT c33
John E. McCullough *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 69-78 (For availability see N73-18866 09-31)
CSCL 20M

The design, construction, and testing of a passive radiative cooler that provides solutions to the design problems of withstanding mechanical stress, achieving the required thermal isolation, and maintaining optical alinement, cleanliness, and integration with the spacecraft are described. Author

N73-18874* Texas Univ., Dallas. Southwestern Medical School.
ZERO GRAVITY TISSUE-CULTURE LABORATORY c11
James E. Cook, P. OB. Montgomery, Jr., and Joseph S. Paul *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 81-89 (For availability see N73-18866 09-31)
CSCL 14B

Hardware was developed for performing experiments to detect the effects that zero gravity may have on living human cells. The hardware is composed of a timelapse camera that photographs the activity of cell specimens and an experiment module in which a variety of living-cell experiments can be performed using interchangeable modules. The experiment is scheduled for the first manned Skylab mission. Author

N73-18875* Aerospace Corp., San Bernardino, Calif.
FRANGIBLE GLASS CANISTERS c14
Richard Seifert *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 91-99 (For availability see N73-18866 09-31)
CSCL 14B

The need for a canister that can release its contents without disturbing the contents dynamically is discussed. The solution of this problem by the use of a frangible glass canister is considered. The basic theory applicable to frangible glass and the method of initiating a command flaw are discussed. A brief description of the test program and the results of a flight test are presented. Author

N73-18876* Boeing Co., Huntsville, Ala.
LUNAR ROVING VEHICLE DEPLOYMENT MECHANISM
Alex B. Hunter and Bryan W. Spacey *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 101-110 (For availability see N73-18866 09-31)
CSCL 22B

The space support equipment that supports the lunar roving vehicle during the flight to the moon and permits the vehicle to be deployed from the lunar module onto the lunar surface with a minimum amount of astronaut participation is discussed. The design and evolution of the equipment are reviewed. The success of the overall lunar roving vehicle design, including the space support equipment, was demonstrated on the Apollo 15 and 16 missions. Author

N73-18877* General Electric Co., Philadelphia, Pa.
RADIOMETER-DEPLOYMENT SUBSYSTEM c14
Kevin M. Speight *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 111-122 (For availability see N73-18866 09-31)
CSCL 14B

A radiometer-deployment subsystem for the Nimbus E spacecraft was designed, developed, and qualified for space use. The dimensions of the radiometer are 0.9 meter square by 0.1 meter, and its weight 32 kilograms. Rigidly secured to the spacecraft during launch, the radiometer is deployed when the spacecraft reaches orbit. Deployment is achieved without permitting any portion of the radiometer to intersect the field of view of the infrared horizon scanner. This accomplishment necessitated a nonlinear deployment profile, which was accomplished by using a four-bar linkage composed of arms, cams, pivots, and steel tapes. Author

N73-18878* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO LUNAR MODULE LANDING GEAR
William F. Rogers *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 123-133 refs (For availability see N73-18866 09-31)
CSCL 22B

The Apollo lunar module landing-gear flight-performance results and three principal gear development problems are discussed. In evaluating the lunar module touchdown performance, strut stroking and toppling stability are the prime factors and are governed primarily by touchdown velocity and surface slope at the touchdown point. Flight results are shown to be well within design values, and the landing-gear has performed successfully in all landings. Author

N73-18879* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 15 MAIN-PARACHUTE FAILURE c02
Donald D. Arabian and Joseph E. Mechelay *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 137-148 (For availability see N73-18866 09-31)
CSCL 01C

In the investigation of the failure of one of the three main parachutes of the Apollo 15 spacecraft, which collapsed at approximately 1825 meters after operating properly from deployment at 3050 meters, three conditions considered to be possible causes of the failure were produced. The suspect conditions were the proximity of the forward heat shield that passed the spacecraft at approximately 1825 meters, the dumping of the reaction control system hypergolic propellants at approximately 1825 meters, and the failing of a riser link found on a recovered parachute. (The failed parachute was not recovered). The remaining two parachutes functioned as planned and averted a catastrophic failure. The conclusions concerning the cause of the failure are discussed. Author

N73-18880* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MECHANICALLY PRESTRESSED WINDOWS
William H. Keathley *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 149-156 (For availability see N73-18866 09-31)
CSCL 22B

A method was developed for mechanically prestressing glass used in spacecraft windows so that surface imperfections of the glass will not propagate under stress. A metal ring, in tension, is placed around the periphery of the glass where the interference fit between the ring and glass fixes the glass in a state of uniform compression. When the glass is subjected to a pressure loading, the compressive prestress prevents tension loading of the outer surface and, therefore, eliminates the tendency for propagation of surface imperfections. Author

N73-18881*+ National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO COUCH ENERGY ABSORBERS
Clarence J. Wesselski and Ralph E. Drexel *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 157-167 refs (For availability see N73-18866 09-31)
Avail: NTIS CSCL 22B

Load attenuators for the Apollo spacecraft crew couch and its potential applications are described. Energy absorption is achieved through friction and cyclic deformation of material. In one concept, energy absorption is accomplished by rolling a compressed ring of metal between two surfaces. In another concept, energy is absorbed by forcing a plastically deformed washer along a rod. Among the design problems that had to be solved were material selection, fatigue life, ring slippage, lubrication, and friction loading. Author

N73-18882* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE LUNAR CART c11
Glenn C. Miller *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 169-179 (For availability see N73-18866 09-31)
CSCL 13F

Expanded experiment-carrying capability, to be used between the Apollo 11 capability and the lunar roving vehicle capability, was defined for the lunar surface crewmen. Methods used on earth to satisfy similar requirements were studied. A two-wheeled cart was built and tested to expected mission requirements and environments. The vehicle was used successfully on Apollo 14.
Author

N73-18883* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LIQUID PUMP FOR ASTRONAUT COOLING c15
Maurice A. Carson *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 181-189 (For availability see N73-18866 09-31)
CSCL 13K

The Apollo portable life support system water-recirculation pump used for astronaut cooling is described. The problems associated with an early centrifugal pump and how these problems were overcome by the use of a new diaphragm pump are discussed. Performance comparisons of the two pump designs are given. Developmental problems and flight results with the diaphragm pump are discussed.
Author

N73-18884* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE APOLLO 14 DOCKING ANOMALY c30
Robert D. Langley *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 191-201 (For availability see N73-18866 09-31)
CSCL 22C

Six docking attempts were required to achieve initial latch engagement during the Apollo 14 translunar docking event. Although subsequent performance of the docking hardware was normal, the docking probe was retained for a thorough postflight investigation. Pertinent design details of the docking system, the mission events related to the anomaly, and a discussion of the postflight investigation of the cause of the anomaly are presented.
Author

N73-18885* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DYNAMIC TESTING OF DOCKING SYSTEM HARDWARE
Wade D. Dorland *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 203-211 refs (For availability see N73-18866 09-31)
CSCL 22B

Extensive dynamic testing was conducted to verify the flight readiness of the Apollo docking hardware. Testing was performed on a unique six degree-of-freedom motion simulator controlled by a computer that calculated the associated spacecraft motions. The test system and the results obtained by subjecting flight-type docking hardware to actual impact loads and resultant spacecraft dynamics are described.
Author

N73-18886* Royal Aircraft Establishment, Farnborough (England).
PLY-TEAR WEBBING ENERGY ABSORBER
Geoffrey W. H. Stevens *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 215-232 (For availability see N73-18866 09-31)
CSCL 22B

Ply-tear webbing is essentially two plain webbings that are bound together by a portion of the warps and that can be torn apart and do work by breaking the binders. Nylon webbings were woven to range in tear force from 1 to 10 kilonewtons. This force is substantially independent of speed, which was as high as 100 m/sec in some cases. A specific energy absorption of 90 J/g was achieved in the dry state. However, lower rated webbings that absorb approximately 40 J/g are recommended for use in practice where it is acceptable.
Author

N73-18887* Hughes Aircraft Co., El Segundo, Calif.
FLEXIBLE SOLAR-ARRAY MECHANISM c14
Merlyn C. Olson *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 233-249 (For availability see N73-18866 09-31)
CSCL 14B

One of the key elements of the flexible rolled-up solar array system is a mechanism to deploy, retract, and store the flexible solar-cell arrays. The selection of components, the design of the mechanism assembly, and the tests that were performed are discussed. During 6 months in orbit, all mission objectives were satisfied, and inflight performance has shown good correlation with preflight analyses and tests.
Author

N73-18888* Lockheed Missiles and Space Co., Sunnyvale, Calif.
SCANNING MIRROR FOR INFRARED SENSORS c14
Richard H. Anderson and Sidney B. Bernstein *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 251-265 (For availability see N73-18866 09-31)
CSCL 20F

A high resolution, long life angle-encoded scanning mirror, built for application in an infrared attitude sensor, is described. The mirror uses a Moire' fringe type optical encoder and unique torsion bar suspension together with a magnetic drive to meet stringent operational and environmental requirements at a minimum weight and with minimum power consumption. Details of the specifications, design, and construction are presented with an analysis of the mirror suspension that allows accurate prediction of performance. The emphasis is on mechanical design considerations, and brief discussions are included on the encoder and magnetic drive to provide a complete view of the mirror system and its capabilities.
Author

N73-18889* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MANIPULATOR TECHNOLOGY FOR THE SPACE SHUTTLE c15
E. Glenn Burroughs *In its* The 7th Aerospace Mech. Symp. Nov. 1972 p 267-274 (For availability see N73-18866 09-31)
CSCL 13H

A shuttle-attached manipulator is currently proposed as the payload-handling device for the space shuttle. Basic requirements for the manipulator involve length, force, compliance, and control. Approaches for studying control methods are presented and simulation methods are discussed. Basic details about the two earthbased manipulators selected for simulation experiments are related to the test methods. Preliminary data from one test are shown as an example of the direction of the testing. A computer-generated simulation is explained, and the relationship of the three simulations to the design problems is discussed.
Author

N73-18890* Kaman Aerospace Corp., Bloomfield, Conn.
A FLYING EJECTION SEAT c02
R. H. Hollrock and J. J. Barzda *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 275-286 (For availability see N73-18866 09-31)
CSCL 06G

To increase aircrewmen's chances for safe rescue in combat zones, the armed forces are investigating advanced escape and rescue concepts that will provide independent flight after ejection and thus reduce the risk of capture. One of the candidate concepts is discussed; namely, a stowable autogyro that serves as the crewman's seat during normal operations and automatically converts to a flight vehicle after ejection. Discussed are (1) the mechanism subsystems that the concept embodies to meet the weight and cockpit-packaging constraints and (2) tests that demonstrated the technical feasibility of the stowage, deployment, and flight operation of the rotor lift system.
Author

N73-18891* Lockheed Missiles and Space Co., Sunnyvale, Calif.
A 928 sq m (10000 sq ft) SOLAR ARRAY c03
Dale E. Lindberg *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 287-302 (For availability see N73-18866 09-31)
CSCL 10A

As the power requirements for space vehicles increase, the area of solar arrays that convert solar energy to usable electrical power increases. The requirements for a 928 sq m (10,000 sq ft) array, its design, and a full-scale demonstration of one quadrant (232 sq m (2500 sq ft)) deployed in a one-g field are described.
Author

N73-18892# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
APOLLO COMMAND MODULE AERODYNAMIC SIMULATION TEST IN HYPERSONIC FLOW
G. Koppenwallner, H. Legge, and H. Mueller 1971 25 p refs
(DLR-FB-71-83) Avail: NTIS HC $3.25; DFVLR Porz: 8 DM

The aerodynamic characteristics of the Apollo Command Module in the hypersonic low density regime were investigated. The experiments were performed in the hypersonic low density tunnels at the AVA Research Center of the DFVLR. This wind tunnel investigation includes: (1) drag measurements at zero lift, (2) three component force measurements, and (3) heat transfer measurements. The results are compared with pertinent U.S. experiments. Author

N73-18893# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
INVESTIGATION OF THE DYNAMIC CHARACTERISTICS OF THE SATELLITE DIAL AFTER SEPARATION FROM THE LAST STAGE
J. Puls and R. Stapf 1972 44 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-74) Avail: NTIS HC $4.25; DFVLR Porz-Wahn: 12,90 DM

An investigation was made of the dynamic characteristics of the satellite Dial after separation from the last stage in order to determine the reasons for abrupt nutations and their good damping. After a summary of the theory of nutation motion of rigid bodies, probable errors during separation are discussed and the equipment on board that might have caused the damping is pointed out. The telemetry data of the attitude measurement system are analysed and the damping effects of the batteries determined by an experiment. Author

N73-18894*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SENSITIVITY OF SPACE SHUTTLE WEIGHT AND COST TO STRUCTURE SUBSYSTEM WEIGHTS
T. E. Wedge and R. P. Williamson Washington NASA Feb. 1973 186 p
(Contract NAS1-11438)
(NASA-CR-2164; LMSC-D282623) Avail: NTIS HC $3.00 CSCL 22B

Quantitative relationships between changes in space shuttle weights and costs with changes in weight of various portions of space shuttle structural subsystems are investigated. These sensitivity relationships, as they apply at each of three points in the development program (preliminary design phase, detail design phase, and test/operational phase) have been established for five typical space shuttle designs, each of which was responsive to the missions in the NASA Shuttle RFP, and one design was that selected by NASA. Author

N73-18895*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSES OF FLIGHT MODEL SPACECRAFT PERFORMANCE DURING THERMAL-VACUUM TESTS
Albert R. Timmins, Robert E. Heuser, and James C. Strain Nov. 1972 56 p refs
(NASA-TM-X-66188; X-326-72-503) Avail: NTIS HC $5.00 CSCL 22B

Malfunction data from the thermal-vacuum tests of 39 flight-model spacecraft were analyzed. The results are interpreted in terms of the test variables, and in terms of the spacecraft performance. The malfunction data are correlated with the test time as a single variable, and also with the composite variable of time plus temperature. The improvement in spacecraft performance is examined by means of malfunction rates, malfunctions per spacecraft, and the probability of no failure related to test time. The minimum thermal-vacuum test profile required for Goddard Space Flight Center spacecraft is verified, and the probability of a defect remaining undetected is estimated. Author

N73-18896*# General Electric Co., Daytona Beach, Fla.
MANNED SPACE PROGRAMS ACCIDENT/INCIDENT SUMMARIES (1963 - 1969)
Mar. 1970 183 p
(Contract NASw-410)
(NASA-CR-120998) Avail: NTIS HC $11.25 CSCL 22D

This summary is a compilation of 508 mishaps assembled from company and NASA records which cover several years of manned space flight activity. The purpose is to provide information to be applied towards accident prevention. The accident/incident summaries are categorized by the following ten systems: cryogenic; electrical; facility/GSE; fuel and propellant; life support; ordnance; pressure; propulsion; structural; and transport/handling. Each accident/incident summary has been summarized by description, cause and recommended preventive action. Author

N73-18897*# Cranston Research, Inc., Alexandria, Va.
MANNED SPACE PROGRAMS ACCIDENT/INCIDENT SUMMARIES (1970 - 1971)
Apr. 1972 136 p
(Contract NASw-2225)
(NASA-CR-120999) Avail: NTIS HC $9.00 CSCL 22D

A compilation of 223 mishaps assembled from company and NASA records covering the Accident/Incident experience in 1970-1971 in the Manned Space Flight Programs is presented. It is the companion volume to NASA-CR-120998 which covered the years 1963-1969. The objective of this summary is to make available to Government agencies and industrial firms the lessons learned from these mishaps. Each accident/incident summary has been reviewed by description, cause and recommended preventive action. The summaries have been categorized by the following ten systems: (1) Cryogenic; (2) Electrical; (3) Facility/GSE; (4) Fuel and Propellant; (5) Life Support; (6) Ordnance; (7) Pressure; (8) Propulsion; (9) Structural; and (10) Transport/Handling. Author

N73-18898*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: COMMAND MODULE UPRIGHTING SYSTEM
Robert D. White Washington Mar. 1973 35 p
(NASA-TN-D-7081; MSC-S-338) Avail: NTIS HC $3.00 CSCL 22B

A water-landing requirement and two stable flotation attitudes required that a system be developed to ensure that the Apollo command module would always assume an upright flotation attitude. The resolution to the flotation problem and the uprighting concepts, design selection, design changes, development program, qualification, and mission performance are discussed for the uprighting system, which is composed of inflatable bags, compressors, valves, and associated tubing. Author

N73-18899*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: PROTECTION AGAINST RADIATION
Robert A. English, Richard E. Benson, J. Vernon Bailey, and Charles M. Barnes Washington Mar. 1973 20 p refs
(NASA-TN-D-7080; MSC-S-329) Avail: NTIS HC $3.00 CSCL 18F

Radiation protection problems on earth and in space are discussed. Flight through the Van Allen belts and into space beyond the geomagnetic shielding was recognized as hazardous before the advent of manned space flight. Specialized dosimetry systems were developed for use on the Apollo spacecraft, and systems for solar-particle-event warning and dose projection were devised. Radiation sources of manmade origin on board the Apollo spacecraft present additional problems. Methods applied to evaluate and control or avoid the various Apollo radiation hazards are discussed. Author

N73-18900*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: ASCENT PROPULSION SYSTEM
Clarence E. Humphries and Reuben E. Taylor Washington Mar. 1973 29 p
(NASA-TN-D-7082; MSC-S-341) Avail: NTIS HC $3.00 CSCL 21H

The development of the Apollo lunar module ascent propulsion subsystem is documented. The ascent propulsion subsystem was

designed, built, and tested to provide propulsive power for launching the ascent stage of the lunar module from the surface of the moon into lunar orbit for rendezvous with the orbiting command and service module. Because total redundancy was prohibitive in this subsystem, special emphasis had to be placed on reliability in design with adequate demonstration short of an extensive flight-demonstration program. The significant technical problems encountered during all phases of the program are identified and the corrective actions are discussed. Based on this experience, several recommendations are made for any future program with similar subsystem requirements. Author

N73-18901*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: LUNAR MODULE STRUCTURAL SUBSYSTEM
Stanley P. Weiss Washington Mar. 1973 23 p
(NASA-TN-D-7084; MSC-S-345) Avail: NTIS HC $3.00 CSCL 22B

In the Apollo Program, the lunar-orbit rendezvous mode was used for the lunar-landing mission. To accomplish the lunar landing, a lunar module spacecraft was built. A description of the design requirements for the structural subsystem and of the structural configuration and the method of design verification are given. A discussion is presented of several problems encountered and the corrective actions taken during the designing, manufacturing, and testing of the lunar module. Author

N73-18902*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: LAUNCH ESCAPE PROPULSION SUBSYSTEM
Neil A. Townsend Washington Mar. 1973 30 p
(NASA-TN-D-7083; MSC-S-343) Avail: NTIS HC $3.00 CSCL 21H

The Apollo launch escape propulsion subsystem contained three solid rocket motors. The general design, development, and qualification of the solid-propellant pitch-control, tower-jettison, and launch-escape motors of the Apollo launch escape propulsion subsystem were completed during years 1961 to 1966. The launch escape system components are described in general terms, and the sequence of events through the ground-based test programs and flight-test programs is discussed. The initial ground rules established for this system were that it should use existing technology and designs as much as possible. The practicality of this decision is proved by the minimum number of problems that were encountered during the development and qualification program. Author

N73-18903*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: SPACECRAFT HEATING ENVIRONMENT AND THERMAL PROTECTION FOR LAUNCH THROUGH THE ATMOSPHERE OF THE EARTH
Robert L. Dotts Washington Mar. 1973 22 p refs
(NASA-TN-D-7085; MSC-S-350) Avail: NTIS HC $3.00 CSCL 22B

The techniques that were used to define the aerothermodynamic environment of the Apollo spacecraft during the boost phase and to predict the structural temperatures of the spacecraft are discussed. The wind-tunnel and radiant-heating tests that were used to support the analytical predictions are discussed. The analytical predictions are discussed. The accuracy of the boost-phase heating-analysis techniques is shown by comparing the techniques with flight data. The analytical techniques for predicting heating characteristics and structural temperatures of the spacecraft were adequate for predicting the temperatures of the Apollo spacecraft during the boost phase. Author

N73-18904# Engins Matra, Velizy (France).
CONTROL OF A COMPENSATED DRAG PROBE. PROJECT SOREL, VOLUMES 1 AND 2 Final Report [CONTROLE D'UNE SONDE A TRAINEE COMPENSEE PROJECT SOREL RAPPORT FINAL]
J. Broquet 26 Jun. 1972 429 p In FRENCH
(Contract ESTEC-1492/71-EL)
(S-3-1949-vol-1+2; ESRO-CR(P)-125) Avail: NTIS HC $28.50

The design report for the SOREL drag free space probe is presented. It contains an analysis of measuring channels, especially as regards coupling and interaction, and a synthetic analysis of the equipment. Coupling problems due to misalignments of the equipment or to dynamic unbalance are solved by a mathematical model and a computer program to be run on an IBM 360/50 with which the proper operation of attitude control and trajectory control can be verified simultaneously. Full details are given on the design of the control channels. The fact that attitude and phase commands cannot be dissociated by a laser mission led to the design, along broad lines, of the phase command.
Author (ESRO)

N73-18905# Gesellschaft fuer Weltraumforschung m.b.H., Porz (West Germany).
THE STATE-OF-THE-ART OF THE HELIOS PROBE SYSTEM [DER ENTWICKLUNGSSTAND DES HELIOS SONDENSYSTEMS]
Friedrich Unz 1972 20 p In GERMAN Presented at the 5th DGLR Ann. Meeting, Berlin, 4-6 Oct. 1972
(DGLR-Paper-72-104) Avail: NTIS HC $3.00

The development phase of the Helios interplanetary probe is reviewed. The solar generator, antenna expand mechanisms and communication equipment are described. Tests carried out on the static and thermal models are discussed. ESRO

N73-18906# Gesellschaft fuer Weltraumforschung m.b.H., Bad Godesberg (West Germany).
SCIENTIFIC PAYLOAD OF THE AEROS SATELLITE [WISSENSCHAFTLICHE NUTZLAST DES SATELLITEN AEROS]
W. Wiche 1972 17 p In GERMAN Presented at the 5th DGLR Ann. Meeting, Berlin, 4-6 Oct. 1972
(DGLR-Paper-72-069) Avail: NTIS HC $3.00

Experiments to be flown onboard the Aeros satellite are described. The technical requirements of the mass spectrometer, the voltage analysis for ion density distribution measurement, the impedance probe, the ultraviolet spectrometer, and the natural gas temperature experiment are analyzed. Their installation in the satellite is discussed. Measurement programs are also considered. ESRO

N73-18907# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE PERIOD 3-26 NOVEMBER 1965
K. S. Russell 4 Dec. 1972 50 p ref
(ROE-STS-134) Avail: NTIS HC $4.50

Estimated azimuth and elevation values of satellites recorded during November 1965 are given. ESRO

N73-18908# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, NOVEMBER 1972
R. D. Eberst 15 Dec. 1972 41 p
(ROE-STS-135) Avail: NTIS HC $4.25

Stopwatch observations made at stations connected with the section during the month of November 1972 are listed in launch and time order for each satellite. Various subtotals are given. Author (ESRO)

N73-18909# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE PERIOD FROM 30 NOVEMBER 1965 17 JANUARY 1966
K. S. Russell 27 Dec. 1972 48 p ref
(ROE-STS-136) Avail: NTIS HC $4.50

Timed observations of satellites, made in azimuth and elevation with a cinetheodolite, are listed in launch and time order for each satellite. Author (ESRO)

N73-18910# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE PERIOD FROM 1966 JANUARY 18 TO 1966 JANUARY 31

K. S. Russell 9 Jan. 1973 38 p ref
(ROE-STS-137) Avail: NTIS HC $4.00

Timed observations of satellites, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in launch and time order for each satellite. Author (ESRO)

N73-18911# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
FABRICATION OF TWENTY-TWO SOUNDING ROCKET VEHICLE SYSTEMS Final Report, 18 Feb. - 30 Sep. 1972
George C. Alford, David M. George, and Paul W. Hoekstra Sep. 1972 19 p refs
(Contract F19628-72-C-0166; AF Proj. 7659)
(AD-753089; AFCRL-72-0533) Avail: NTIS CSCL 19/7

Twenty-two sounding rocket systems were prepared and delivered by Thiokol Chemical Corporation consisting of fourteen Ute-Tomahawk vehicles and eight Paiute-Tomahawk vehicles. In addition to fabrication, assembly and adjustment of vehicle components, Thiokol provided additional related support to Air Force Cambridge Research Laboratories in the form of static tests and computational, analytical, and field engineering services. Rocket motors and igniters; the TE-416 Tomahawk, the TU-715 Ute, and the TU-716 Paiute were major components of the twenty-two sounding rocket systems. Other system components included the Ute/Paiute tail assembly, launch lugs, Ute/Paiute-Tomahawk interstage adapter, Tomahawk tail assembly, and Tomahawk despin modules. Four Paiute booster motors were statically fired to verify the propellant batch. Computations and analyses were completed for Ute/Paiute-Tomahawk vehicles to allow theoretical prediction of trajectories, roll rate and pitch natural frequency histories, static stabilities, wind weighting data, and heating analyses. Author (GRA)

N73-18912# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GENERAL TRENDS IN GUIDED MISSILE DEVELOPMENT
Mirko Boras and Stevan Rogic 31 Aug. 1973 31 p Transl. into ENGLISH from Vazduhoplovni Glas. (Yugoslavia), v. 15, no. 6, 1958 p 699-718
(AF Proj. J206)
(AD-753510; FTD-HC-23-0633-72) Avail: NTIS CSCL 16/4

The authors discuss the general trends in guided missile development. Since World War 2 technical development in weapons has done much to promote the future development of guided missile systems. The development of missile systems has also necessitated research into launching sites and their use. Research studies are being conducted on range capability, speed, altitude, weight, accuracy, guidance, warheads and cost. The guided missile is a major military weapon to be reckoned with in a future war. Missile development has advanced rapidly and is playing an increased military role. Author (GRA)

N73-18913# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
EFFECTS OF VERTICAL WIND ON TACTICAL ROCKETS AND ARTILLERY SHELLS Research and Development Technical Report
Bernard F. Engebos Nov. 1972 20 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-753349; ECOM-5467) Avail: NTIS CSCL 19/4

Vertical wind effects on the Honest John (M50) tactical rocket and the 155 millimeter howitzer projectile are discussed. Theoretical trajectory simulations were calculated with quadrant elevations of 200, 400, and 800 mils. It was found that the vertical wind component can play a significant role on the impact points of an Honest John fired at a low angle and a 155 howitzer fired at a high angle. With the aid of vertical wind measurements, more accurate impact points could be obtained. Author (GRA)

N73-18914# Naval Weapons Lab., Dahlgren, Va.
NAVAL WEAPONS, LABORATORY PRECISION EPHEMERIS
Ted Sims Sep. 1972 18 p refs
(AD-753807; NWL-TR-2872) Avail: NTIS CSCL 22/3

For several years the Naval Weapons Laboratory has computed precise satellite ephemerides. The ephemerides, computed for Navy navigation satellites which are accurate to about 5 meters, are widely used for radar calibration and in determining positions of observing stations. The report summarizes computational procedures, coordinate frames, output forms and output formats pertinent to the ephemerides which are produced. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-18915*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
ELASTO-PLASTIC BENDING OF CRACKED PLATES, INCLUDING THE EFFECTS OF CRACK CLOSURE Ph.D. Thesis
David Paul Jones Oct. 1972 136 p refs Supported in part by AEC
(Grant NGL-39-002-023)
(NASA-CR-112268; SM-83A) Avail: NTIS HC $9.00 CSCL 20K

A capability for solving elasto-plastic plate bending problems is developed using assumptions consistent with Kirchhoff plate theory. Both bending and extensional modes of deformation are admitted with the two modes becoming coupled as yielding proceeds. Equilibrium solutions are obtained numerically by determination of the stationary point of a functional which is analogous to the potential strain energy. The stationary value of the functional for each load increment is efficiently obtained through use of the conjugate gradient. This technique is applied to the problem of a large centrally through cracked plate subject to remote circular bending. Comparison is drawn between two cases of the bending problem. The first neglects the possibility of crack face interference with bending, and the second includes a kinematic prohibition against the crack face from passing through the symmetry plane. Results are reported which isolate the effects of elastoplastic flow and crack closure. Author

N73-18916# Advisory Group for Aerospace Research and Development, Paris (France).
AD HOC GROUP ON LOW-CYCLE HIGH TEMPERATURE FATIGUE
J. M. Drapier (Centre de Rech. Met., Liege) Dec. 1972 33 p refs
(AGARD-R-604) Avail: NTIS HC $3.75

This report presents information on the activities in low cycle fatigue testing at high temperature (LCHTF) as received from 57 laboratories (industry and universities) in 9 NATO nations. The information includes the interest and activity in LCHTF testing techniques and conditions used. Author

N73-18917# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
CALCULATION OF NATURAL VIBRATIONS OF SINGLY CURVED OPEN CYLINDRICAL PANELS
G. Kotowski 1971 107 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-92) Avail: NTIS HC $7.50; DFVLR Porz-Wahn: 57 DM

The vibration behavior of cylindrically curved panels is treated analytically by application of the Ritz method taking into account the characteristic bending vibration functions of the uniform beam to represent the plate deflections. The analytical relations are given in a general valuable form for arbitrary boundary conditions. For the panel clamped at one curved edge and free at the others, and for the panel clamped at all four edges numerical results are presented and discussed in detail. Author

N73-18918# National Aerospace Lab., Tokyo (Japan).
AN ELASTIC-PLASTIC ANALYSIS OF A CRACK WITH LINEARLY DISTRIBUTED STRESS IN THE PLASTIC ZONE
Hiroyuki Terada 1972 10 p refs In JAPANESE; ENGLISH summary
(NAL-TR-293) Avail: NTIS HC $3.00

The state of stress and deformation at the crack tip is investigated analytically for the case where a finite plastic zone exists along the crack line. The size of the plastic zone and the

crack opening displacement are calculated when an infinite plate containing a single crack is subjected to uniaxial extension applied normal to the crack line. The calculations show the effect of work hardening of the material. It is shown that the size of the plastic zone is almost equal to that for small scale yielding when the ratio of the crack tip stress to the yield stress is 3.0. Author

N73-18919# Aeronautical Research Labs., Melbourne (Australia).
EXPERIMENTAL DETERMINATIONS OF STRAIN FIELDS RESULTING FROM INTERFERENCE FIT TAPERED PINS
R. P. Carey Jun. 1972 65 p refs
(ARL/SM-Note-377) Avail: NTIS HC $5.25

Four experimental techniques were used to examine the strain fields around tapered interference fit steel pins in plates of steel and of aluminum alloy. On individual plates variation of the order of 20% to 40% was found between strains measured by the same technique at points equidistant from the pin. Average strains on individual plates ranged from 74% to 118% of the theoretical strain when allowance was made for an initial ineffective pin insertion distance. Author

N73-18920# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
STRESS WAVES IN FINITE LONGITUDINALLY LAYERED SHELLS
M. Ziv Jun. 1972 62 p refs
(TAE-154) Avail: NTIS HC $5.25

The transient response of a finite longitudinally-layered cylindrical membrane shell impacted by longitudinal axisymmetric loads is obtained. Membrane stress distribution and particle velocities are determined for the entire solution domain. The method of solution consists of characteristics finite difference technique and discontinuity relations. A characteristics finite difference integration scheme is constructed for regions where the variables are continuous. Discontinuities relations are developed to encounter the impulsive leading wave and its reflection and refraction at the interfaces. An example problem which demonstrates the method is solved. Author

N73-18921# Tokyo Univ. (Japan). Inst. of Industrial Science.
ANALYSIS OF GEOMETRICALLY NONLINEAR AND STABILITY PROBLEMS BY STATIC PERTURBATION METHOD
Yasuhiko Hangai and Shigeya Kawamata Jan. 1972 64 p refs *Its* Serial No. 143, vol. 22, no. 5
Avail: NTIS HC $5.25

The use of the static perturbation procedure as a consistent method to study geometrically nonlinear equilibrium and stability problems of structural elements and systems is discussed. Data cover geometrically nonlinear equilibrium path of the prebuckling stage, finding and classifying different types of critical points and extending the equilibrium path beyond the critical point to the post buckling region, and determining the influence of imperfections on the critical points. Author

N73-18922# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
FATIGUE DAMAGE CUMULATION FOR ROUND STEEL SPECIMENS WITH TRANSVERSE HOLES (K SUB T EQUALS 2) IN COMPARISON WITH DAMAGE CUMULATION FOR OTHER SPECIMEN TYPES
A. Buch and F. Weinstein Nov. 1972 58 p refs
(TAE-164) Avail: NTIS HC $5.00

Fatigue damage cumulation of low-carbon steel specimens with transverse hole (K sub T = 2.04) were investigated in two-step rotating-bending tests with H-L, L-H and block loading sequence. Both amplitude levels sigma sub 1 and sigma sub 2 were much higher than the fatigue limit level and the difference sigma sub 1 - sigma sub 2 was not large. Various initial stress cycle ratios in two-step tests or various cycle ratios in block tests were used. The tests show that cycle ratio sums were always greater than 1. In the case when the second or the third step was at the fatigue limit level cycle ratio sums were mostly lower than 1 but cycle ratio sums were greater than one at failure. Author

N73-18923# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
PHOTOELASTIC ANALYSIS OF THE STRESS FIELD SURROUNDING A FATIGUE CRACK
A. Berkovits, A. A. Betser, and A. Assa Jun. 1972 25 p refs
(TAE-155; Rept-160-065) Avail: NTIS HC $3.25

A photoelastic analysis was carried out on plane polyester specimens containing a fatigue crack, in order to study the effect of plastic yielding around the crack tip on the elastic stress distribution in the vicinity of the crack. In general results were in good agreement with values calculated for the case of a sharp-tipped crack. However, very near the crack tip principal stresses obtained experimentally were slightly lower than calculated stresses, probably due to the bluntness of the fatigue crack. Also lines of constant stress tended to move behind the crack tip, in contrast with the calculated stresses, which occurred further forward over the field of investigation. Author

N73-18924# Aeronautical Research Labs., Melbourne (Australia).
A UNIFIED THEORY OF STRUCTURAL FATIGUE
D. G. Ford May 1972 50 p refs
(ARL/SM-Note-338) Avail: NTIS HC $4.50

A three stage model is described for the fatigue failure of a structure with several critical regions for initial failure. It is assumed that crack initiation, the first stage, is random while the second stage of crack growth is deterministic although affected by the scatter in initiation. The third stage is fracture of the weakened structure. The basic solution is probabilistic in nature and most closely related to the cumulative damage laws describing the initial failures. The model requires the use of Bastenaire damage theory but as this is extremely general the restriction here is only slight. In the context of the model the nature of the stress governing the initiation and growth of cracks is arbitrary. This means that the practical form of the stress analysis may be suited to the particular structure under study. Similarly the crack growth laws may be chosen from experiment. For aircraft structures where the technique is likely to be most useful it is suggested that matrix force methods of stress be used, combined with crack growth described by fracture mechanics. Author

N73-18925# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE TESTING: OBJECTIVES, PHILOSOPHIES AND PROCEDURES
J. Y. Mann Feb. 1972 59 p refs
(ARL/Sm-Note-336) Avail: NTIS HC $5.00

A review is presented of the general problems of fatigue failures which lead to the necessity for the fatigue testing of materials, components and structures. The objectives of a fatigue testing program are discussed and the philosophies associated with various testing procedures such as constant amplitude, program loading, random loading and flight-simulation are outlined. An indication of the significance of the variables to be considered in setting up a representative fatigue test is given, together with the application of statistical methods for the estimation of service lives. Recommendations are made regarding the various parameters involved in carrying out a simulated laboratory fatigue test. These include the test spectrum, periodic loads, load sequence, maximum and minimum loads, numbers of load levels and cyclic frequency. Author

N73-18926# Defence Research Establishment Valcartier (Quebec).
ON THE PENETRATION OF TRUNCATED CONES INTO DUCTILE TARGETS
P. N. Brooks and Y. Martel Oct. 1972 51 p refs
(DREV Proj. 97-01-19)
(DREV-R-655/72) Avail: NTIS HC $4.75

Truncated cones are used in low-speed penetration experiments to provide a nonzero force gradient at the start of penetration and eliminate position and/or bluntness errors which occur when sharply pointed cones are used. Three models are presented which approximate the effect of the flat tip on the resistance to penetration. Comparisons are made with the results of tests carried out on targets made of annealed copper and 65-S aluminum in the T6, T4 and O conditions. It is found that work-hardening effects are important, particularly in the early stages of penetration during which geometric similarity may not be assumed. It is also found that a functional relationship exists

between the ratio of the hardness on the crater wall to the original hardness and the ratio of the ultimate tensile strength to the yield strength. Author

N73-18927*# Oklahoma State Univ., Stillwater.
A THEORETICAL ANALYSIS OF THE FREE VIBRATIONS OF RING- AND/OR STRINGER-STIFFENED ELLIPTICAL CYLINDERS WITH ARBITRARY END CONDITIONS. VOLUME 1: ANALYTICAL DERIVATION AND APPLICATIONS
Donald E. Boyd and C. K. P. Rao Washington NASA Feb. 1973 118 p refs
(Grant NGR-37-002-089)
(NASA-CR-2151) Avail: NTIS HC $3.00 CSCL 20K

The derivation and application of a Rayleigh-Ritz modal vibration analysis are presented for ring and/or stringer stiffened noncircular cylindrical shells with arbitrary end conditions. Comparisons with previous results from experimental and analytical studies showed this method of analysis to be accurate for a variety of end conditions. Results indicate a greater effect of rings on natural frequencies than of stringers. Author

N73-18928*# Ohio State Univ. Research Foundation, Columbus.
FREE VIBRATIONS OF THERMALLY STRESSED ORTHOTROPIC PLATES WITH VARIOUS BOUNDARY CONDITIONS
Cecil D. Bailey and James C. Greetham Washington NASA Feb. 1973 101 p refs
(Grant NGR-36-008-109)
(NASA-CR-2174) Avail: NTIS HC $3.00 CSCL 20K

An analytical investigation of the vibrations of thermally stressed orthotropic plates in the prebuckled region is presented. The investigation covers the broad class of trapezoidal plates with two opposite sides parallel. Each edge of the plate may be subjected to different uniform boundary conditions. Variable thickness and arbitrary temperature distributions (analytical or experimental) for any desired combination of boundary conditions may be prescribed. Results obtained using this analysis are compared to experimental results obtained for isotropic plates with thermal stress, and to results contained in the literature for orthotropic plates without thermal stress. Good agreement exists for both sets of comparisons. Author

N73-18929*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
ON-LINE FAILURE DETECTION AND DAMPING MEASUREMENT OF AEROSPACE STRUCTURES BY RANDOM DECREMENT SIGNATURES
Henry A. Cole, Jr. Washington NASA Mar. 1973 78 p refs
(Contract NAS2-6824)
(NASA-CR-2205) Avail: NTIS HC $3.00 CSCL 20K

Random decrement signatures of structures vibrating in a random environment are studied through use of computer-generated and experimental data. Statistical properties obtained indicate that these signatures are stable in form and scale and hence should have wide application in one-line failure detection and damping measurement. On-line procedures are described and equations for estimating record-length requirements to obtain signatures of a prescribed precision are given. Author

N73-18930*# Structures Research Associates, Laguna Beach, Calif.
USER DOCUMENT FOR COMPUTER PROGRAMS FOR RING-STIFFENED SHELLS OF REVOLUTION
Gerald A. Cohen Washington NASA Mar. 1973 297 p refs
(Contract NAS1-10091)
(NASA-CR-2086) Avail: NTIS HC $3.00 CSCL 20K

A user manual and related program documentation is presented for six compatible computer programs for structural analysis of axisymmetric shell structures. The programs apply to a common structural model but analyze different modes of structural response. In particular, they are: (1) Linear static response under asymmetric loads; (2) Buckling of linear states under asymmetric loads; (3) Nonlinear static response under axisymmetric loads; (4) Buckling nonlinear states under axisymmetric loads; (5) Imperfection sensitivity of buckling modes under axisymmetric loads; and (6) Vibrations about nonlinear states under axisymmetric loads. These programs treat branched shells of revolution with an arbitrary arrangement of a large number of open branches but with at most one closed branch. Author

N73-18931# Advisory Group for Aerospace Research and Development, Paris (France).
SUMMARY AND EVALUATION OF SPECIALISTS MEETING ON STRESS CORROSION TESTING METHODS
Donald E. Piper (Lockheed Missiles and Space Co., Inc., Palo Alto, Calif.) Dec. 1972 11 p refs
(AGARD-AR-52) Avail: NTIS HC $3.00

A summary is presented of the two-day Specialists Meeting on Stress Corrosion Testing Methods held during the 33rd Meeting of the Structures and Materials Panel of the Advisory Group for Aerospace Research and Development (AGARD) in Brussels, Belgium, on October 5 and 6, 1971. The program was prepared to promote free and candid discussion of (1) the utility and significance of stress-corrosion data to current engineering and design practices, (2) the progress being made by NATO countries toward standardization of test techniques for stress-corrosion cracking, and (3) those test methods which might be recommended as standard techniques in the immediate future. Author

N73-18932*# Structural Composites Industries, Inc., Azusa, Calif.
GLASS FIBER REINFORCED METAL PRESSURE VESSEL DESIGN GUIDE
R. E. Landes Jul. 1972 112 p refs Prepared in cooperation with Boeing Co., Seattle
(Contract NAS3-14380)
(NASA-CR-120917) Avail: NTIS HC $7.75 CSCL 11D

The Engineering Guide presents curves and general equations for safelife design of lightweight glass fiber reinforced (GFR) metal pressure vessels operating under anticipated Space Shuttle service conditions. The high composite vessel weight efficiency is shown to be relatively insensitive to shape, providing increased flexibility to designers establishing spacecraft configurations. Spheres, oblate spheriods, and cylinders constructed of GFR Inconel X-750, 2219-T62 aluminum, and cryoformed 301 stainless steel are covered; design parameters and performance efficiencies for each configuration are compared at ambient and cryogenic temperature for an operating pressure range of 690 to 2760 N/sq cm (1000 to 4000 psi). Design variables are presented as a function of metal shell operating to sizing (proof) stress ratios for use with fracture mechanics data generated under a separate task of this program. Author

N73-18933# National Aerospace Lab., Tokyo (Japan). First Airframe Div.
NATURAL VIBRATION AND FLUTTER OF CYLINDRICALLY CURVED PANELS
Yuji Matsuzaki 18 Sep. 1972 27 p refs Backup document for AIAA Synoptic scheduled for publication in the AIAA Journal in Jun. 1973
Avail: NTIS HC $3.50

Influences of in-plane boundary conditions and panel geometry on natural vibration and flutter characteristics of panels exposed to a supersonic flow parallel to the generators are analyzed with the aid of Galerkin's method within the framework of Reissner's shallow shell theory. Almost all of the results are obtained by using twelve assumed modes which are a combination of the first six streamwise and the first two symmetrical spanwise modes. Convergence of flutter solutions is checked by taking the first ten streamwise terms at the most. The numerical results reveal that influences of in-plane boundary conditions and panel geometry are much more complicated than previously reported. Author

N73-18934# Institut Franco-Allemand de Recherches, St. Louis (France).
STATIC (EVENLY DISTRIBUTED LOAD) AND DYNAMIC (GRADUATED LOAD) STUDY OF THIN CIRCULAR PLATES OF VARIABLE THICKNESS [ETUDE STATIQUE (CHARGE UNIFORME) ET DYNAMIQUE (ONDE EN ECHELON) DE PLAQUES CIRCULAIRES, MINCES, D'EPAISSEUR VARIABLE]
M. Schaffar 18 Feb. 1972 103 p refs In FRENCH
(Contract DTEN-71.70.185)
(ISL-4/72) Avail: NTIS HC $7.25

A global method and a finite difference method were used to analyze the static and dynamic response of thin circular plates, either clamped or supported. The global method applies natural frequencies and functions to thickness variations which follow an exponential law. The finite difference method was applied to thickness variations which follow a parabolic law. The comparison of results obtained by both methods has determined the optimum blast load resistance of circular plates with the same mass. It is concluded that optimum blast behavior is obtained with a plate that is thicker at the center than along the sides. Calculated results are in agreement with those of experiments. ESRO

N73-18935# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
CONSTRUCTION, SCOPE AND USE OF THE TEST FACILITIES AT THE ISD Final Report [AUFBAU, UMFANG UND ANWENDUNG DER VERSUCHSANLAGEN IM ISD]
John H. Argyris, Werner Aicher, Klaus Eberle, and Wolfram Haug Feb. 1972 57 p refs In GERMAN; ENGLISH summary
(Contract RFF-4019)
(ISD-119) Avail: NTIS HC $5.00

Computational methods for accurate determination of the behavior of engineering structures, including deformations, dynamic response, ultimate load, and service life are described. These methods take advantage of modern computers. The methods have been applied to structures in all fields of engineering. Large scale structural tests and experimental material investigations are required for further development of analytical methods. Author (ESRO)

N73-18936# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
ON THE APPLICATION OF THE SHEBA SHELL ELEMENT
John H. Argyris and N. Lochner 1972 38 p refs
(ISD-127) Avail: NTIS HC $4.00

The applications are discussed of the SHEBA triangular thin shell element with variable curvature developed in order to analyze both small and large deformation behavior of shells of arbitrary shape, within a finite element method. A number of examples are presented which illustrate the appropriate mapping procedures and the pertinent rules for the boundary conditions. The simulation of singularities is also shown. Comparison with exact or nearly exact analytical results as well as other finite elements of numerical procedures confirms the high accuracy achieved with the SHEBA element. Applications include loading conditions of toruses, cooling towers, hemispherical shells, hyperbolic paraboloid roof, circular plates, circular shells, and skew plates. Author (ESRO)

N73-18937# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
METHODS FOR CALCULATING EIGENVALUES AND EIGENVECTORS OF NON HERMITIAN MATRICES WITH SPECIAL CONSIDERATION OF STRUCTURAL DYNAMICS PROBLEMS [EINIGE VERFAHREN ZUR BERECHUNG VON EIGEN WERTEN UND EIGENVEKTOREN VON NICHT HERMITESCHEN MATRIZEN UNTER BESONDERER BERUECKSICHTIGUNG STRUKTURDYNAMISCHER PROBLEME]
O. E. Broenlund and J. Buehlmeier Jul. 1972 44 p refs In GERMAN
(ISD-128) Avail: NTIS HC $4.25

A generalized Aronszajn-Patton algorithm was developed in real arithmetic as a method for calculating the eigenvalues and eigenvectors of non-Hermitian matrices, which can be applied to structural dynamics problems. An extension of the algorithm was also developed by means of which a diagonalization can be reached for multiple eigenvalue groups. Matrices can be treated which have minimal polynomials with multiple zeros, but which nevertheless have linear elementary parts. In addition, the generalized algorithm enables development of a method which uses only real arithmetic, based on invariant subspaces, and is suitable for application to dynamic structural matrices with multiple eigenvalues, or groups with multiple eigenvalues and nonlinear elementary parts. ESRO

N73-18938# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
NOTCH STRESSES ON THE LOAD-CARRYING CORE [KERBSPANNUNGEN AM LASTTRAGENDEN KERN]
Dieter Radaj and Walter Kandel 1972 31 p refs In GERMAN
(Contract T-I-3/62-803-K-301)
(ISD-129) Avail: NTIS HC $3.75

The notch stresses of a square elastic core, loaded by a single force or a single moment, in an extended plate, are calculated using the finite element method. They are indicated for different dimensions as a function of the core stiffness. The maximum notch stress value of the elastic core can be estimated from the maximum notch stress value of a rigid core in a homogeneous plate, and in the opening, if the notch stress maximum also appears in the rounding of an elastic core. ESRO

N73-18939# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
STRESS AND DEFORMATION EFFECTS ON THE TRANSVERSE STIFFNESS OF THIN-WALLED U-BEAMS [KRAEFTE UND FORMAENDERUNGEN AN DER QUERSTEIFE DUENNWANDIGER U-STAEBE]
Dieter Radaj and Neoklis Zafirakopoulos 1972 44 p refs In GERMAN
(Contract T-I-3/62-803-L-301)
(ISD-130) Avail: NTIS HC $4.25

The elastic properties of the lateral stiffness of thin walled U beams are examined under stresses occurring during torsion, eccentric drawing, and lateral bending (flexing-torsion stresses). The flexing-torsion stiffness of the lateral stiffness, necessary for a simplified theory of thin walled beams, is analyzed for beams of different geometry, sizes, and supports, with and without short beam ends, and loading by a bimoment. Dimensionless flexing-torsion values are indicated as a result. These values should be utilized in connection with a shearing correction in the simplified theory for thin walled beams. ESRO

N73-18940# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
CALCULATION OF A UNIAXIAL STEEL WIRE-PLASTIC COMPOSITE USING THE FINITE ELEMENT METHOD [BERECHNUNG EINES EINACHSIGEN STAHLDRAHT-KUNSTSTOFF-VERBUNDES UNTER EINSATZ DER FINIT-ELEMENT-METHODE]
H. P. Mlejner 1972 35 p refs In GERMAN
(ISD-131) Avail: NTIS HC $3.75

The analysis of stresses in the plastic body of a steel wire-plastic composite under uniaxial loading is presented. The spatial problem is reduced to a plane problem, which is solved using the finite element method and the ASKA system. It is shown that, although the single components of the stresses are closely related to the relative gap width of the composite, unloading effects take place for small gap widths which can invert these relations when the reference stress is in agreement with the energy conversion hypothesis. ESRO

N73-18941# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
FORTRAN SUBROUTINES FOR FINITE ELEMENT ANALYSIS
B. C. Merrifield London Aeron. Res. Council 1972 48 p refs Supersedes RAE-TR-71156; ARC-33734
(ARC-CP-1223; RAE-TR-71156; ARC-33734) Avail: NTIS HC $4.50; HMSO 80 p; PHI $3.55

Twelve subroutines, written in CIL 1900 FORTRAN are presented for matrix and other operations which are commonly encountered in the finite element analysis of structures. Although the subroutines have been developed specifically to deal with problems concerning flat plates they clearly possess some wider generality. Details are given of each subroutine including its method of use and its complete listing. Author (ESRO)

N73-18942# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPAL RELATIONSHIPS OF THE THEORY OF ELASTIC ORTHOTROPIC PLATES OF VARIABLE RIGIDITY WITH ACCOUNT TAKEN OF TRANSVERSE SHEAR
I. G. Amirkhanov 27 Oct. 1972 16 p refs Transl. into ENGLISH from Issled. po Teorii Plastin i Obolochek (USSR), no. 7. 1970 p 727-734

(AD-752708; FTD-HT-23-1509-72) Avail: NTIS CSCL 13/13

The theory of elastic sandwich shells is generalized to the case of plates of arbitrary contour where thickness and elasticity modulus are functions of the coordinates of the middle surface. The relationships obtained permit establishing the area of applicability of the classical theory. GRA

N73-18943# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CONCERNING THE EFFECT OF THE ECCENTRICITY OF REINFORCEMENT UPON THE STABILITY OF CYLINDRICAL SHELLS

K. E. Byrsan, S. N. Kan, and D. S. Chernyakov 10 Nov. 1972 12 p Transl. into ENGLISH from Tr. Vses. Konf. po Teorii Plas i Obolochek (USSR), 1970 p 110-113

(AF Proj. 1369)

(AD-752691; FTD-HT-23-1062-72) Avail: NTIS CSCL 20/11

The article deals with circular cylindrical shells of arbitrary length, which are regarded as structurally anisotropic. The problem of stability is solved by the energy method. Hypotheses of the absence of shears in the middle surface and other inextensibility of the contour of the cross section were adopted. The expressions for the critical loads as functions of the parameters of wave formation with an axially symmetric initial state of the shell were obtained from a solution of the equation of Euler's variational problem. Note is taken of weakening of the effect of the influence of eccentricity with an increase in the length of the shell. Author (GRA)

N73-18944# California Univ., Los Angeles.

FEATHER: FINITE ELEMENT ANALYSIS FOR THREE-DIMENSIONAL ELASTIC RESPONSE Final Report, Mar. 1969 - Jun. 1972

L. G. Selna and J. E. Serpanos China Lake, Calif. Naval Weapons Center. Aug. 1972 137 p refs

(Contract N00123-69-C-1249)

(AD-753211; NWC-TP-5402) Avail: NTIS CSCL 20/11

A digital computer program for three-dimensional stress analysis of complex structures is presented. The solution is based on the finite element technique employing a general 8-nodal point element with 3 translational degrees of freedom per nodal point. The UNIVAC 1108 computer program is coded in FORTRAN IV; the plotting capabilities are designed for use with the SC-4060 software. Author (GRA)

N73-18945# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRESS CONCENTRATIONS NEAR OPENINGS IN PLATES AND SHELLS MADE OF REINFORCED MATERIALS, CHAPTER 9

G. A. Van Fo Fy 27 Oct. 1972 33 p refs Transl. into ENGLISH from the book "Kompozitsionne Volokniste Materialy" Kiev, 1970 p 149-166

(AD-753041; FTD-HT-23-1383-72) Avail: NTIS CSCL 13/13

Contents: Stress concentration near round laminated glass-fiber-reinforced plastics; Distribution of stresses near an elliptical opening and a slit in a plate made of glass-fiber-reinforced plastic; Methods of studying stresses in three-layer spherical bottoms with a rigid filler and with openings; Concentration of stresses near openings in a three-layer spherical shell with a light filler. GRA

N73-18946*# George Washington Univ., Washington, D.C. Dept. of Civil Mechanical and Environmental Engineering.

AN APPROXIMATE ANALYSIS OF THE BUCKLING OF IMPERFECT SPHERICAL SHELLS Technical Report, 1966 - 1971

Barry I. Hyman Jan. 1972 41 p refs

(Grant NGR-09-010-053; Contract N00014-66-C-0154; SF0130302)

(NASA-CR-130961; AD-749349; TR-5) Avail: NTIS HC $4.25 CSCL 20K

An approximate method is presented for predicting elastic collapse of complete spherical shells subject to uniform external pressure. The shell contains an imperfection in the form of an isolated flat spot and the snap through behavior of the flat spot region is analyzed. The existence of higher modes is demonstrated and the effect of various choices for the stiffness coefficients at the edge of the flat spot is investigated. Author (GRA)

N73-18947# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

ELASTO-PLASTIC RESPONSE OF PLATES TO BLAST LOADING Final Technical Report, Jul. 1971 - Aug. 1972

Alan T. Barnard and Peter W. Sharman Sep. 1972 60 p refs

(Contract DAJA37-71-C-4061)

(AD-752449; Rept-72R06) Avail: NTIS CSCL 20/11

The report describes, in some detail, a proposed computer program for the dynamic analysis of elasto-plastic, thin, isotropic plates of rectangular planform. Specific dynamic loading is considered which is appropriate to a blastwave, namely, a spatially constant pressure with infinitesimal rise time, decaying rapidly to a suction peak and finally to ambient conditions. Account is taken of the large deformations of the plate, and fixed or simply-supported boundary conditions. Much of the program has been coded and step-by-step testing of the various subroutines is currently progressing. A flow chart of the main program is given as is a statement of the subroutine testing completed at the publication date. Author (GRA)

N73-18948# Wisconsin Univ., Madison. Mathematics Research Center.

THE GOVERNING EQUATIONS AND EXTREMUM PRINCIPLES OF ELASTICITY AND PLASTICITY GENERATED FROM A SINGLE FUNCTIONAL

M. J. Sewell Aug. 1972 91 p refs

(AD-753137; MRC-TSR-1227) Avail: NTIS CSCL 20/11

A new theoretical framework is described which generates, in a characteristic or canonical form, the governing equations and (if appropriate) inequalities of a wide class of problems in applied mathematics from a single generating functional. Variational and dual extremum principles are expressed in terms of that functional. The theory is first illustrated by applying it to the familiar contexts of classical elasticity and the rigid/plastic yield-point problem. Precise identification of certain linear operators and inner product spaces is entailed. The unifying effect of the theory is emphasized by working out further applications in finite elasticity and in incremental plasticity from a stressed state with allowance for geometry changes. New results are obtained, and the connection is indicated between certain approximate methods of structural mechanics, in particular the finite element method. Author (GRA)

N73-18949# Wisconsin Univ., Madison. Mathematics Research Center.

A YIELD SURFACE CORNER LOWERS THE BUCKLING STRESS OF AN ELASTIC/PLASTIC COMPRESSED PLATE

M. J. Sewell Oct. 1972 62 p refs

(Contract DA-ARO(D)-31-124-462)

(AD-753136; MRC-TSR-1226) Avail: NTIS CSCL 20/11

The bifurcation stress is calculated for a simply supported elastic/plastic plate in uniaxial compression, in the case when the stress is at a vertex of the yield surface which is locally similar to that of Tresca. The effect of coupled hardening between yield surface facets which meet at the vertex is included. It is found that the bifurcation stress may be substantially lower than that associated with the Mises yield surface. The latter is known to give results too high to be reconciled with experiment. Reductions of order 10-30% are shown to be unexceptional, even with the retention of an elastic value for the shear modulus. Author (GRA)

N73-18950# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

NONLINEAR DYNAMICS OF HEMISPHERICAL SHELLS

J. M. Klosner and R. Longhitano Nov. 1972 49 p refs

(Contract N00014-67-A-0438-0006; NR Proj. 064-427)

(AD-752795; PIBAL-72-33) Avail: NTIS CSCL 20/11

The nonlinear dynamic response of a thin, clamped hemispherical shell subjected to a suddenly applied pressure is obtained. The governing fourth order, coupled, nonlinear equations are rewritten in finite difference form and the resulting matrix equation is partitioned into a form to which Lu factorization can be readily applied. A dynamic buckling criterion is used, and both the

axisymmetric and asymmetric responses are investigated.
Author (GRA)

N73-18951# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
FEABL (FINITE ELEMENT ANALYSIS BASIC LIBRARY) USER'S GUIDE
Oscar Orringer and Susan E. French Aug. 1972 110 p refs
(Contract F44620-70-C-0020; AF Proj. 9782)
(AD-753120; ASRL-TR-162-3; AFOSR-72-2228TR) Avail: NTIS CSCL 20/11

The guide contains complete instructions for the use of FEABL, a basic software system developed for finite element analysis at the MIT Aeroelastic and Structures Research Laboratory. FEABL has been designed primarily for (but is not limited to) the specialized type of continuum analysis problem encountered in the materials laboratory. FEABL has also been used successfully as an educational tool in the finite element analysis course given by the MIT Department of Aeronautics and Astronautics. The software is modular, and is written in machine-independent FORTRAN 4 for the IBM 370/155. A complete program listing is contained in Appendix C. Element subroutines which can be used either independently or in conjunction with FEABL will be presented in future publications. Author (GRA)

N73-18952# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
EFFECT OF STRESS-GRADIENT ON THE ELASTIC-PLASTIC BEHAVIOR OF THICK WALLED CYLINDERS
Gary S. Shears, Sharad A. Patel, and B. Venkatraman Dec. 1972 28 p refs
(Contract F44620-69-C-0072; AF Proj. 9782)
(AD-753121; PIBAL-72-36; AFOSR-72-2281TR) Avail: NTIS CSCL 13/13

The elastic-perfectly plastic behaviors of thick-walled circular cylinders under internal pressure are investigated in the present report. The investigations are based on a modified form of Tresca yield condition in which the effects of stress gradients are taken into account. Firstly, it is assumed that the cylinder is incompressible in the elastic range as it is in the plastic range. Next, the cylinder is considered to be compressible in the elastic range. Author (GRA)

N73-18953# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PRECURSORY SILOED MISSILE GEOKINETIC STUDY, HILL AIR FORCE BASE, UTAH Air Force Surveys in Geophysics
Francis A. Crowley, Henry A. Ossing, and Gerry H. Cabaniss 5 Sep. 1972 31 p refs
(AF Proj. 7628)
(AD-753079; AFCRL-72-0531; AFCRL-AFSG-245) Avail: NTIS CSCL 16/1

A siloed missile facility was occupied over a fortnight for the purpose of determining site related limitations for conducting a long-term geokinetic study. The study focused on the ground-silo-missile mount transmissibility characteristics and the field evaluation of prototype hardware. Broadband motion measurements were made of the effects of near-site loading, explosive generated motions, and environmental motions peculiar to the site. Results are presented in spectral formats. Study objectives have been met; the implementation for a long-term geokinetic siloed missile study is practicable. Author (GRA)

N73-18954# Washington Univ., Seattle. Dept. of Mechanical Engineering.
FRACTURE DYNAMICS OF HOMALITE-100 SHEETS
A. S. Kobayshi, B. G. Wade, and W. B. Bradley Sep. 1972 28 p refs
(Contract N00014-67-A-0103-0018; NR Proj. 064-478)
(AD-749098; TR-15) Avail: NTIS CSCL 20/11

Fracture dynamics of Homalite-100 plates is discussed in the context of linear theory of fracture mechanics. Dynamic photoelasticity is used for dynamic analysis and finite element method is used for static analysis. Static and dynamic strain energy release rates and kinetic energy release rates for constant velocity, accelerating and decelerating cracks are determined for tension loaded and impacted pretensioned plates. Author

N73-18955# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
STATIC, VIBRATION, AND THERMAL STRESS ANALYSES OF LAMINATED PLATES AND SHELLS BY THE HYBRID-STRESS FINITE-ELEMENT METHOD, WITH TRANSVERSE SHEAR DEFORMATION EFFECTS INCLUDED
Sheng-Taur Mau and Emmett A. Witmer Oct. 1972 131 p refs
(Contract DAAG46-72-C-0029; DA Proj. 1W0-62113-A-661)
(AD-753651; ASRL-TR-169-2; AMMRC-CTR-72-24) Avail: NTIS CSCL 11/4

A method of analyzing laminated-composite, linear-elastic plate and shell structures has been developed based on the hybrid-stress finite-element model. Flat-plate elements are used for both plate and shell structures. Three quadrilateral elements designated by ELEM1, ELEMZ, and ELEMR, all with linear in-plane boundary displacement and linear in-plane stress assumptions, are chosen for use. Transverse shear deformation effects, and rotary as well as in-plane inertia, are included in all of these elements. The ELEM1 element can be applied to single-layer thin or moderately thick plates and shells. The ELEMR element can be applied to multilayer thin plates and shells, and the ELEMZ element may be used to analyze single-layer or multilayer, thin or thick plates and shells. Author (GRA)

N73-18956# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE METHOD OF CORRELATION EQUATIONS IN THE EVALUATION OF STRUCTURAL STRENGTH AND RELIABILITY
M. Ya. Shashin, Yu. D. Zheleznyakov, and S. L. Manevich 17 Nov. 1972 14 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Mashinostr. (Moscow) no. 5, 1971 p 55-59
(AF Proj. 7351)
(AD-753497; FTD-HT-23-1274-72) Avail: NTIS CSCL 20/11

A great deal of experimental material (cyclic strength of Chromansil steel, growth of fatigue cracks in marine sheet steel, the persistent strength of polymethylmethacrylate) is used to demonstrate the effectiveness of the application of statistical processing on the basis of a compilation of correlation equations, the parameters of which become stable in the case of the selection of more than 20 samples in the selection, which facilitates the determination of prediction reliability. Author (GRA)

N73-18957# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIRST ORDER INTERNAL STRESSES UNDER UNIDIRECTIONAL AND REVERSE FRICTION
V. D. Evdokimov and G. E. Movsesov 25 Oct. 1972 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 1, 1972 p 1-44
(AF Proj. 7343)
(AD-751723; FTD-HT-23-936-72) Avail: NTIS CSCL 20/11

The effect of reversibility of sliding on the curve of internal stresses of the first order during friction on thin plates is discussed, and also the effects of lubrication, including surfactants, on the character of the curves of internal stresses. An example of the friction of red copper plates is used to show the difference in internal stresses appearing respectively in surface layers in the presence of unidirectional and reverse sliding. Author

N73-18958# Connecticut Univ., Storrs. Dept. of Metallurgy.
STRUCTURAL FATIGUE Annual Report, Jun. 1971 - Jun. 1972
A. J. McEvily, Jr. 1 Jun. 1972 45 p refs
(Contract F44620-69-C-0011; AF Proj. 9560; Proj. Themis)
(AD-753687; UC-Met-7-72; AFOSR-72-2326TR) Avail: NTIS CSCL 11/6

Research was conducted in the areas of fracture mechanics and mechanisms, environmental influences on fatigue, dislocation behavior, alloy preparation, the use of X-ray diffraction in fatigue, and in non-destructive testing. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-18959# National Lending Library for Science and Technology, Boston Spa (England).

A STUDY OF THE THERMAL PHYSICS OF AN IN-LINE ARRAY OF TUBES IN A TRANSVERSE FLOW OF AIR AT HIGH REYNOLDS NUMBERS

P. S. Samoshka and Yu. K. Stasyulyavichyus Nov. 1972 15 p refs Transl. into ENGLISH from Liet. TSR Mokslu Akad. Darb., Ser. B (Vilnyus), v. 4, no. 55, 1968 p 133-145
(NLL-RTS-7689) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.40

Measurements were made of the heat transfer and aerodynamic resistance of eight arrangements of in-line smooth walled tube arrays, with specific transverse pitches of 1.26 to 2.52, and specific longitudinal pitches of 1.13 to 2.26. This operation took place in transverse air currents of Reynolds numbers between Re = 15,000 and 1 1/2 million. In addition to changes in aerodynamic resistance, an abrupt change to higher heat transfer conditions occurs between Re = 100,000 and 200,000. It was found that the efficiency of in-line arrays in a transverse air current at large Reynolds numbers increases with increase of the packing density of the tubes or with increase of the pitch on the face of the bank and reduction of the pitch across the depth of the bank. J.M.M.

N73-18960*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE GAINS BY USING HEATED NATURAL-GAS FUEL IN AN ANNULAR TURBOJET COMBUSTOR

Nicholas R. Marchionna Washington Mar. 1973 20 p refs
(NASA-TM-X-2742; E-7236) Avail: NTIS HC $3.00 CSCL 21E

A full-scale annular turbojet combustor was tested with natural gas fuel heated from ambient temperature to 800 K (980 F). In all tests, heating the fuel improved combustion efficiency. Two sets of gaseous fuel nozzles were tested. Combustion instabilities occurred with one set of nozzles at two conditions: one where the efficiency approached 100 percent with the heated fuel; the other where the efficiency was very poor with the unheated fuel. The second set of nozzles exhibited no combustion instability. Altitude relight tests with the second set showed that relight was improved and was achievable at essentially the same condition as blowout when the fuel temperature was 800 K (980 F). Author

N73-18961# Weapons Research Establishment, Salisbury (Australia).

A FORTRAN PROGRAM FOR PREDICTING THE TEMPERATURE-TIME HISTORIES OF HEMISPHERICAL SHELLS SUBJECTED TO AERODYNAMIC HEATING

I. C. Heron Oct. 1972 55 p refs
(WRE-TN-783(WR/D)) Avail: NTIS HC $4.75

A method is described for calculating the inner and outer surface temperatures of a hemispherical head subjected to aerodynamic heat transfer. In designing rocket-borne experiments it is often necessary to predict the temperature that will be experienced by the nose section. This temperature is governed by the thickness of the shell, the trajectory of the rocket vehicle and the thermal properties of the shell material. The computer program described uses these parameters to predict the required temperature-time histories. Modified Newtonian theory, which describes fairly accurately the pressure distribution around a hemisphere, is first used to calculate local flow properties at specific stations. The method of Van Driest is then applied, together with a form factor and corrections for compressibility, to calculate local heat-transfer coefficients. Compressibility is accounted for by means of the intermediate enthalpy method. Both radial and circumferential heat flow are taken into account. To operate the program input data must be provided to specify the rocket vehicle trajectory and the free stream flow properties as functions of time. Author

N73-18962# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

PROBLEMS OF MIXING AND SUPERSONIC COMBUSTION OF HYDROGEN IN HYPERSONIC RAMJETS

Otto Leuchter 1971 29 p refs In FRENCH and GERMAN; ENGLISH summary Presented at the combined session of the DGLR Sci. Comm. for Air Breathing Propulsions and for Chem. Propulsions, Traven, 11 May 1971
(ONERA-TP-973) Avail: NTIS HC $3.50

The mixing and ignition of hydrogen jets injected normally into a supersonic two-dimensional flow are discussed. The specific application is to investigate the combustion performance of a hypersonic ramjet engine. An analysis of experimental results obtained at Mach 1.5 has shown empirical relations for the jet penetration and crosswise distribution of fuel with respect to thermal blockage. Mixing of hydrogen and air was examined in optimal penetration conditions to establish the length necessary to obtain complete mixing. A significant reduction of ignition lengths, as compared to the theoretical values corresponding to the thermal conditions of the steady upstream flow, was shown to occur. Author

N73-18963# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

SURVEY OF ONERA AND SNPE WORK ON COMBUSTION INSTABILITY IN SOLID PROPELLANT ROCKETS

Marcel Barrere, Lionel Nadaud, and Jean Noel Lhuillier (Soc. Natl. des Poudres et Explosifs) 1972 13 p refs Presented at 8th Conf. of AIAA/SAE de Specialistes de la Propulsion, Nouvelle-Orleans, France, 29 Nov. - 1 Dec. 1972
(ONERA-TP-1165; AIAA-Paper-72-1052) Avail: NTIS HC $3.00

Results are presented, obtained at ONERA in order to determine the response of a solid propellant to pressure and velocity fluctuations. Two different experimental techniques have been developed. A first line of research makes use of rockets known to be unstable (L or T rocket motors); the comparison of cold and hot tests shows the low credibility of the results on T rockets motors; the nonhomogeneity of temperature is scale dependent. A second line of research uses rockets with a forced geometrical variation of the throat section. These methods are discussed in some detail from the experimental and theoretical stand points. Here again cold gas comparative tests emphasize the effect of combustion or the observed gain. A linear theory predicts the observed trends. Author

N73-18964# Joint Publications Research Service, Arlington, Va.

SUMMARIES OF REPORTS FROM THE SYMPOSIUM: THE KINETICS AND THERMODYNAMICS OF PROCESSES OF INTERACTION OF GASES WITH LIQUID METALS

21 Feb. 1973 39 p refs Transl. into ENGLISH from "Kinetika i Termodinamika Protsessov Vzaimodeystviya Gazov s Zhidkimi Metallami" USSR, 17-19 Oct. 1972 p 3-50
(JPRS-58282) Avail: NTIS HC $4.00

Summaries of reports from the symposium The Kinetics and Thermodynamics of Processes of Interaction of Gases with Liquid Metals are given. The symposium was held in Moscow from 17 to 19 October 1972. Author

N73-18965*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

MEASURED CATALYCITIES OF VARIOUS CANDIDATE SPACE SHUTTLE THERMAL PROTECTION SYSTEM COATINGS AT LOW TEMPERATURES

Carl D. Scott Washington Mar. 1973 23 p refs
(NASA-TN-D-7113; MSC-S-348) Avail: NTIS HC $3.00 CSCL 20M

Atom recombination catalytic rates for surface coatings of various candidate thermal protection system materials for the space shuttle vehicle were obtained from measurements in arc jet, air flow. The coatings, chrome oxides, siliconized carbon/carbon, hafnium/tantalum carbide on carbon/carbon, and niobium silicide, were bonded to the sensitive surface of transient slug calorimeters that measured the heat transfer rates to the coatings.

The catalytic rates were inferred from these heat transfer rates. Surface temperatures of the calorimeters varied from approximately 300 to 410 K. Author

N73-18966*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AFTERBURNER PERFORMANCE OF CIRCULAR V-GUTTERS AND A SECTOR OF PARALLEL V-GUTTERS FOR A RANGE OF INLET TEMPERATURES TO 1255 K (1800F)
Robert J. Brandstetter and Gregory M. Reck Washington Mar. 1973 40 p refs
(NASA-TN-D-7212; E-7262) Avail: NTIS HC $3.00 CSCL 21B

Combustion tests of two V-gutter types were conducted in a 19.25-in. diameter duct using vitiated air. Fuel spraybars were mounted in line with the V-gutters. Combustor length was set by flame-quench water sprays which were part of a calorimeter for measuring combustion efficiency. Although the levels of performance of the parallel and circular array afterburners were different, the trends with geometry variations were consistent. Therefore, parallel arrays can be used for evaluating V-gutter geometry effects on combustion performance. For both arrays, the highest inlet temperature produced combustion efficiencies near 100 percent. A 5-in. spraybar - to - V-gutter spacing gave higher efficiency and better lean blowout performance than a spacing twice as large. Gutter durability was good. Author

N73-18967*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF AN EXPERIMENTAL SHORT-LENGTH ANNULAR COMBUSTOR: ONE-SIDE-ENTRY DILUTION AIRFLOW CONCEPT
Francis M. Humenik and James A. Biaglow Washington Mar. 1973 47 p refs
(NASA-TN-D-7225; E-7267) Avail: NTIS HC $3.00 CSCL 21B

A test program was conducted to evaluate an experimental short-length annular combustor that uses a one-side-entry dilution airflow concept. The combustor design features scoops on the outer liner for controlling the primary- and secondary-zone airflow distribution. Combustor inlet total pressures were limited to 62 N/sq cm (90 psia) with inlet-air temperatures from 590 K (600 F) to 890 K (1150 F). At a diffuser inlet Mach number of 0.25, the exit temperature pattern factor was 0.44 with an average exit temperature of 1436 K (2124 F) and a total pressure loss of 4.3 percent. At a diffuser inlet Mach number of 0.31, the exit temperature pattern factor was reduced to 0.29 with an average exit temperature of 1450 K (2151 F) and a total pressure loss of 6.1 percent. Nominal combustion efficiencies of 100 percent were obtained with the ASTM A-1 fuel. Exhaust gas emissions, smoke, and altitude relight data are included with exit-temperature profiles and distribution patterns. Author

N73-18968*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COOLANT-SIDE HEAT-TRANSFER RATES FOR A HYDROGEN-OXYGEN ROCKET AND A NEW TECHNIQUE FOR DATA CORRELATION
Ralph L. Schacht and Richard J. Quentmeyer Washington Mar. 1973 48 p refs
(NASA-TN-D-7207; E-7204) Avail: NTIS HC $3.00 CSCL 20M

An experimental investigation was conducted to determine the coolant-side, heat transfer coefficients for a liquid cooled, hydrogen-oxygen rocket thrust chamber. Heat transfer rates were determined from measurements of local hot gas wall temperature, local coolant temperature, and local coolant pressure. A correlation incorporating an integration technique for the transport properties needed near the pseudocritical temperature of liquid hydrogen gives a satisfactory prediction of hot gas wall temperatures. Author

N73-18969# Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENT OF LINEAR THERMAL DILATATION COEFFICIENTS OF EXPLOSIVE MONOCRYSTALS [MESURES DES COEFFICIENTS DE DILATATION THERMIQUE LINEAIRE SUR DES MONOCRISTAUX D'EXPLOSIFS]
A. Lichtenberger 6 Sep. 1971 36 p refs In FRENCH (ISL-24/71) Avail: NTIS HC $4.00

The thermal dilatation coefficients were determined for RDX and PETN monocrystals along their crystallographic axes, in the 20 to 100 C temperature range, using extensometric gages. The results have shown that there was an anisotropy of the thermal expansion coefficient for particular crystallographic directions. The anisotropy presents a correlation with variations of the detonation speed according to the propagation direction. Author (ESRO)

N73-18970# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
SOUND AMPLIFICATION AND NOISE REDUCTION OF FLAMES INFLUENCED BY SOUND [SCHALLVERSTAERKUNG UND GERAEUSCHMINDERUNG BEI SCHALLBEEINFLUSSTEN FLAMMEN]
Peter E. M. Schneider and Dietrich Rapp Jul. 1972 70 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft (Rept-8/1972) Avail: NTIS HC $5.50; Max-Planck-Inst. fuer Stroemungsforsch: 34 DM

The following problems were experimentally investigated: is it possible to produce a sound sensitive flame with a flame front far enough away from the nozzle exit so that a sound sensitive gas jet is available between flame front and nozzle; can this cut-off flame be excited by a sound signal to radiate sound; can the noise of a cut-off flame be reduced by a sound signal. In the course of the investigations it appeared that sound radiation and noise reduction can be obtained for a cut-off flame by a sound signal. It is found that sound radiation and noise reduction can be traced back to the periodic formation of vortices, which codetermine the combustion reactions in the flame front. The investigated flames have therefore been designated as vortex flames, of which the harmonic flame assumes very characteristic flame forms. ESRO

N73-18971# Atlantic Research Corp., Alexandria, Va.
COMPOSITION AND COMBUSTION CHARACTERISTICS OF CONDENSED EXHAUST FROM BORON-CONTAINING FUEL-RICH ROCKET MOTORS
Andrej Macek and J. McKenzie Semple Oct. 1972 18 p refs (Contract F44620-71-C-0124; AF Proj. 9711)
(AD-753105; AFOSR-72-2379TR) Avail: NTIS CSCL 21/2

The objective of this work has been to characterize the nature of the primary exhaust from fuel-rich boron-containing (ca. 50%) rocket motors, and to study its combustion. Two formulations were studied, each at two pressures. Solid materials collected from motor firings were examined microscopically, analyzed chemically, and studied for ignition temperatures and burning times, t(b). Both the theory and the experiment show that boron undergoes substantial chemical reaction in primary combustion. Both soluble and insoluble boron compounds form. Author (GRA)

N73-18972# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BURNING IN A FLOW (SELECTED ARTICLES)
M. I. Lysov and M. K. Maksutova 14 Jul. 1972 224 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Kazan), no. 124, 1970 p 1-203
(AD-753062; FTD-HT-23-73-72) Avail: NTIS CSCL 21/2

The collection of articles contains the results and much experimental data from studies on flow combustion performed over recent years. The problems investigated include turbulence characteristics and their effect on flame-out (separation) limits; stabilizer design and combustion stability; problems in two-stage combustion; combustion chamber design; gas-dynamic flame stabilization, and other problems and proposals. Author (GRA)

N73-18973*# California Univ., Berkeley. Coll. of Engineering.
EXPERIMENTAL STUDY OF THE DYNAMICS OF A SPHERICAL FLAME
A. K. Oppenheim, M. M. Kamel, and C. Varvatsoulis 1972 17 p refs Repr. from Proc. JANAF Combust. 7th CPIA Pub 204, Feb. 1971, v. 1, 1972 p 553-567
(Grants NGR-05-003-050; AF-AFOSR-0129-67; NSF GK-2156; AF Proj. 9711)

(NASA-CR-130963; AD-750004; AFOSR-72-1941TR) Avail: NTIS HC $3.00 CSCL 21B

Preliminary results of an experimental study conducted to investigate the dynamic behavior of flames in explosive gases are presented. The medium was an equimolar acetylene-oxygen mixture maintained initially at a pressure of 110 torr. and room temperature in an experimental vessel 9 cm in internal diameter. Ignition was performed by means of a neodymium laser beam focused on a 0.3 mm diameter steel wire. Experimental observations were performed by the use of a stroboscopic laser-schlieren system yielding a set of photographic records of wave phenomena at a frequency of 200,000 frames per second. The records reveal the existence of a number of shocks which by a thorough analysis of the blast wave generated by the ignition process, are shown to be due entirely to the flame generated flow field. Author (GRA)

N73-18974# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ANALYSIS OF THE STAGE-BY-STAGE PROCESS OF THE COMBUSTION OF METHANE UNDER ISOTHERMAL CONDITIONS

N. V. Lavrov and G. V. Grebenshchikova 10 Nov. 1972 19 p refs Transl. into ENGLISH from the book "Vopr. Teorii Goreniya, Tr. Obshchemoskovskogo Seminara po Teorii Goreniya" Moscow, Izd.-vo Nauka, 1970 p 126-134

(AD-752862; FTD-MT-24-1485-72) Avail: NTIS CSCL 21/2

The mechanism of methane combustion in air at 1000-4000K was studied and the composition of gaseous mixtures for various initial compositions during the combustion was calculated by assuming a 4 stage oxidation process and by analyzing the changes in thermodynamic functions. Author (GRA)

N73-18975# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

ASSESSMENT OF POLLUTANT MEASUREMENT AND CONTROL GOALS FOR MILITARY AIRCRAFT ENGINES

William S. Blazowski and Robert E. Henderson Nov. 1972 72 p refs

(AF Proj. 3048; AF Proj. 3066)

(AD-753095; AFAPL-TR-72-102) Avail: NTIS CSCL 13/2

The problem of mass emissions from aircraft gas turbine engines is briefly reviewed and the aspects of this problem which are unique to military aircraft operation are discussed. Pollutant measurement technology and the existing data base are summarized and candidate control techniques are identified. Proposed Environmental Protection Agency regulations for aircraft engine emissions are examined in terms of their impact on and application to military engines. It is concluded that the special considerations, both performance and otherwise, which must be afforded to military aircraft prohibit direct application of the EPA regulations. The report concerns Air Force emission limitation goals established in light of these efforts. Maximum allowable idle combustion inefficiency, oxide of nitrogen emission (1bm/1000 lbm fuel), and smoke number are specified. The rationale behind using these parameters, and the means by which the numerical goals were derived are discussed. Author (GRA)

N73-18976# Defense Documentation Center, Alexandria, Va.

PYROTECHNICS Report Bibliography, Nov. 1956 - Feb. 1972

Nov. 1972 252 p refs

(AD-752700; DDC-TAS-72-66) Avail: NTIS CSCL 19/1

The bibliography is a collection of unclassified references to unclassified reports on pyrotechnics. These references pertain to composition, safety, design, configuration, launching, binders, release mechanisms, performance and capability of pyrotechnics. Flares, munitions, grenades, cartridges, bombs, and projectiles containing chemicals that produce brilliant light for illumination or colored lights or smoke for transmitting information for military purposes are discussed. Corporate author-monitoring agency, subject, title, and personal author indexes are included. Author (GRA)

N73-18977# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COMBUSTION CHAMBER WITH STREAM STABILIZATION OF FLAME AND THE RESULTS OF TESTING IT

V. A. Khristich and A. F. Minyailo 27 Nov. 1972 13 p refs Transl. into ENGLISH from Vestn. Kiev. Politekh. Inst., Ser. Teploenerg. (Kiev), no. 7, 1970 p 76-81

(FTD Proj. T71-04-03)

(AD-753518; FTD-MT-24-1493-72) Avail: NTIS CSCL 21/2

Results of testing of a combustion chamber with a burner device using a system of transverse air streams for stabilization are presented. Tests showed the efficiency and good operating characteristics of the device: high combustion density over a broad range of operating modes, stable operation without a pilot flame, low pressure losses and low metal temperature of flame tube. Author (GRA)

N73-18873* Little (Arthur D.), Inc., Cambridge, Mass.

RADIATIVE COOLER FOR SPACECRAFT

John E. McCullough *In* NASA. Lyndon B. Johnson Space Center The 7th Aerospace Mech. Symp. Nov. 1972 p 69-78

(For availability see N73-18866 09-31)

CSCL 20M

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-18978*# Tracor, Inc., Austin, Tex.

EVALUATION OF NOISE POLLUTION LEVEL BASED UPON COMMUNITY EXPOSURE AND RESPONSE DATA

Richard D. Edmiston 1 Dec. 1972 114 p refs

(Contract NASw-2304; TRACOR Proj. 076-166)

(NASA-CR-130920; T-72-AU-9086-U) Avail: NTIS HC $7.75 CSCL 05K

The results and procedures are reported from an evaluation of noise pollution level as a predictor of annoyance, based on aircraft noise exposure and community response data. The measures of noise exposure presented include composite noise rating, noise exposure forecast, noise and number index. A proposed measure as a universal noise exposure measure for noise pollution level (L sub NP) is discussed. F.O.S.

N73-18979*# Research Triangle Inst., Durham, N.C. Environmental Technology.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION TECHNOLOGY APPLICATION TEAM PROGRAM Monthly Summary Report, Nov. 1972

30 Nov. 1972 136 p refs

(Contract NASw-2459)

(NASA-CR-130990) Avail: NTIS HC $9.00 CSCL 05B

Contracts are reported between the RTI TATeam and the National Aeronautics and Space Administration (NASA), the Environmental Protection Agency (EPA), and other governmental, educational, and industrial organizations participating in NASA's Technology Utilization Program. Author

N73-18980# National Science Foundation, Washington, D.C.

FEDERAL FUNDS FOR RESEARCH DEVELOPMENT AND OTHER SCIENTIFIC ACTIVITIES, FISCAL YEARS 1971, 1972, AND 1973, VOLUME 21

1973 210 p refs

(NSF-72-317-Vol-21) Avail: SOD $2.75

A broad picture is presented of the distribution of Federal R and D funds to major areas of effort. The information presented includes levels and trends, character of work, and geographical distribution. F.O.S.

N73-18981*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AIR-CUSHION TANKERS FOR ALASKAN NORTH SLOPE OIL

John L. Anderson Washington Mar. 1973 30 p refs

(NASA-TM-X-2683; E-7210) Avail: NTIS HC $3.00 CSCL 01C

A concept is described for transporting oil from the Arctic to southern markets in 10,000-ton, chemically fueled air-cushion

vehicles (ACV's) configured as tankers. Based on preliminary cost estimates the conceptual ACV tanker system as tailored to the transportation of Alaskan North Slope oil could deliver the oil for about the same price per barrel as the proposed trans-Alaska pipeline with only one-third of the capital investment. The report includes the description of the conceptual system and its operation; preliminary cost estimates; an appraisal of ACV tanker development; and a comparison of system costs, versatility, vulnerability, and ecological effect with those of the trans-Alaska pipeline. Author

N73-18982# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 300
31 Jan. 1973 32 p refs Transl. into ENGLISH from various Eastern European publications
(JPRS-58121) Avail: NTIS HC $3.75

Articles are presented on the development of and progress in the various theoretical and applied scientific disciplines and technical fields. The administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences are examined. Author

N73-18983# Aviation Advisory Commission, Washington, D.C.
THE LONG RANGE NEEDS OF AVIATION: TECHNICAL ANNEX TO THE REPORT OF THE AVIATION ADVISORY COMMISSION, VOLUME 1
Jan. 1973 598 p refs 2 Vol.
(PB-215803) Avail: NTIS HC $12.50

The findings and recommendations of the Aviation Advisory Commission are presented. In the process of arriving at these findings and recommendations, the Commission took into consideration, among other things, an extensive body of information developed for it by its staff, consultants, contractors, and many informed and concerned persons who communicated directly with the Commission or participated in discussions and conferences sponsored by the Commission on matters of particular interest. The purpose of this technical annex is to provide, for those interested in the additional depth and detail of the foundation underlying the Commission's studies, the more significant background material developed by the various sources of information. Author

N73-18984# Aviation Advisory Commission, Washington, D.C.
THE LONG RANGE NEEDS OF AVIATION: TECHNICAL ANNEX TO THE REPORT OF THE AVIATION ADVISORY COMMISSION, VOLUME 2
Jan. 1973 471 p refs 2 Vol.
(PB-215804) Avail: NTIS HC $10.60

Special issues and problems involved in the long range needs of aviation are analyzed. The subjects discussed are (1) noise problems created by aircraft operation, (2) air service to small and isolated communities, (3) general aviation requirements, and (4) financial aspects of the aerospace industry. P.N.F.

N73-18985# National Bureau of Standards, Washington, D.C.
INDEX TO THE REPORTS OF THE NATIONAL CONFERENCE ON WEIGHTS AND MEASURES FROM THE FIRST TO THE FIFTY-SIXTH, 1905 TO 1971
Frances C. Bell Feb. 1973 47 p refs
(NBS-SP-377; LC-73-600013) Avail: SOD $0.75 domestic postpaid or $0.50 GPO bookstore

The publication comprises a subject index and a speaker index for the reports of the National Conference on Weights and Measures from the first (1905) through the fifty-sixth (1971) meeting. Author

N73-18986# Washington Univ., Seattle. Nuclear Physics Lab.
[RESEARCH PROGRESS IN ACCELERATOR AND ION SOURCE DEVELOPMENT, DETECTOR AND COMPUTER SYSTEMS, AND VARIOUS NUCLEAR PHYSICS PROJECTS] Annual Report
Jun. 1972 199 p refs
(Contract AT(45-1)-1388)
Avail: NTIS HC $12.00

Emphasis during the year was placed on making the polarized ion source a reliable laboratory tool. Also, studies of heavy ion reactions were conducted including double isobaric spin-flip following Li-6 + Li-6 collisions, and transfer reactions among other light nuclei, as well as one and two nucleon transfer near the Coulomb barrier of heavy nuclei. The population and gamma decay properties of fission isomers were investigated. In addition, coincidence experiments showed moderately large cross sections for alpha particles to pick up a neutron to form an unstabble He-5 nucleus. The pulsed proton beam was used in measuring electromagnetic half lives of less than a nanosecond. Also, initial studies are included of inner shell ionization produced in heavy ion bombardment, J.M.M.

N73-18987# National Science Foundation, Washington, D.C.
AN ANALYSIS OF FEDERAL R AND D FUNDING BY FUNCTION, FISCAL YEARS 1963-1973
Jun. 1972 93 p refs
(NSF-72-313) Avail: SOD $2.50

Graphs and tables are presented of the R and D funding by budget function and by a proposed alternative system. As previously arranged, the agency R and D programs are distributed according to the functional categories of the Federal budget, and R and D expenditures within each function are compared with total outlays for that function. The alternative classification system relates expenditures more closely to the national purposes and objectives they are designed to support. N.E.N.

N73-18988# National Science Foundation, Washington, D.C.
[NATIONAL AND INTERNATIONAL RESEARCH AND EDUCATION PROJECTS] Annual Report for Fiscal Year 1972
1972 112 p
(NSF-73-1; AR-22) Avail: SOD $2.50

The research activities supported by the National Science Foundation are reported. The activities reported include the research project support areas, national and international programs, research applications, science education, and institutional programs. F.O.S.

N73-18989# Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
DO WE NEED A GENERAL REMOTE SENSING PROGRAM IN THE FEDERAL REPUBLIC? [BRAUCHEN WIR IN DER BUNDESREPUBLIK EIN GESAMTPROGRAMM FERNERKUNDUNG?]
R. Muehlfeld 1972 11 p In GERMAN Presented at the 5th DGLR Ann. Meeting, Berlin, 4-6 Oct. 1972
(DGLR-Paper-72-072) Avail: NTIS HC $3.00

Methods used for remote sensing and the advantages of a remote sensing earth resources program are surveyed. The possibility of developing such a global program in Germany instead of limited activities supervised by different ministries is discussed. Some ideas are presented on how a global program should be organized and what it should include. ESRO

N73-18990# Gesellschaft fuer Weltraumforschung m.b.H., Porz (West Germany).
EXPERIENCE GAINED FROM THE GERMAN SCIENTIFIC SPACECRAFT PROGRAM [BISHERIGE ERFAHRUNGEN AUS DEM DEUTSCHEN WISSENSCHAFTLICHEN RAUMFAHRZEUGPROGRAMM]
Ants Kutzer 1972 22 p In GERMAN Presented at the 5th DGLR Ann. Meeting, Berlin, 4-6 Oct. 1972
(DGLR-Paper-72-052) Avail: NTIS HC $3.25

The project management organization by the German Society for Space Research, which is the contracting authority for the Azur, Aeros, Dial and Helios satellites, is surveyed. Management problems during the different development stages are discussed. Internal management organization and methods are described. Experience gained on cost, performance, and delay analysis will be used in the future for setting up management teams. ESRO

N73-18991# Air Force Systems Command, Washington, D.C.
PROCEEDINGS OF THE AIR FORCE SYSTEMS COMMAND 1972 SCIENCE AND ENGINEERING SYMPOSIUM, VOLUME 2
19 Oct. 1972 615 p refs Symp. held at San Antonio, 17-19 Oct. 1972

(AD-753072; AFSC-TR-72-005-Vol-2) Avail: NTIS CSCL 05/2

The report is a compilation of technical papers relevant to Air Force research in science and engineering. GRA

N73-18992# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE CONTEMPORARY SCIENTIFIC AND TECHNOLOGICAL REVOLUTION

V. I. Belolipetskii, A. Kuzin et al 25 Aug. 1972 278 p refs Transl. into ENGLISH of the publ. "Sovremennaya Nauchno-Tekhnicheskaya Revolyutsiya" Moscow, 1967 p 1-185

(AD-751509; FTD-MT-24-553-72) Avail: NTIS CSCL 05/1

The book discloses urgent problems in contemporary processes connected with the violent development of science and technology. The essence and nature of the contemporary scientific and technological revolution are examined; its consequences in conditions of socialism and capitalism are considered. The development of automation, cybernetics, the use of new materials, the mastery of cosmic space, the transformation of science into a direct productive force, etc. are pointed out. In connection with this a critique is presented of bourgeois concepts of the second industrial revolution. Author (GRA)

N73-18993# Polytechnic Inst. of Brooklyn, N.Y. Microwave Research Inst.

[RESEARCH OF THEORETICAL PHYSICS, MATHEMATICS, AND ENGINEERING, INCLUDING STUDIES ON MEASUREMENTS AND MATERIALS] Progress Report, 15 Sep. 1971 - 14 Sep. 1972

Arthur A. Oliner Nov. 1972 369 p refs Sponsored in part by AROD and ONR

(Contract F44620-69-C-0047; AF Proj. 4751)

(AD-753710; PIBMRI-R-452.37-72; AFOSR-72-1913TR; PR-37) Avail: NTIS CSCL 05/2

Contents: Electromagnetics and waveguide techniques; Quantum electronics and optics; Plasma physics and energy conversion; Solid state and materials; Communications and computers; Systems, control, and network theory. GRA

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EUROPEAN

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Liquid Propellant Rocket Combustion Instability (NASA SP–194)

Edited by DAVID T. HARRJE AND FREDERICK H. REARDON

This reference book presents the significant theoretical and experimental developments in the field of combustion instability. As an aid to development, design, and research engineers, fundamental principles and relations between alternate approaches are emphasized. Also discussed are the phenomena of combustion instability, combustion, and flow processes. Basic concepts of various analytical models are given along with descriptions of how to use each model. Methods for exciting and damping instability oscillations are presented along with experimental techniques used to investigate instability problems. *Paperbound.* 664 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $5.50.

NASA Contributions to Fluidic Systems (NASA SP–5112)

By TERRY M. WEATHERS

A technology utilization survey describing how the specialized requirements of NASA and others have influenced the evolution of fluidic systems through study of promising applications, ranging from controls for a nuclear rocket engine (where radiation presents serious problems for electronic systems) to fluidic control of automatic turret lathes. The fluidics industry is also discussed. *Paperbound.* 112 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $1.00.

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